VOL. XLIX, No. 6 JUNE, 1954

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features in this issue...

Rumen Sampling: A Diagnostic Aid

Stomach Parasites of Cattle

Foreign Animal Diseases: A Threat to the Livestock Industry

Aerosol Properties of Lyophilized Hog Cholera Virus

Application of Pancreatic Dornase

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Cesarean Section in the Chinchilla

Evaluation of Meperidine Hydrochloride in the Cat

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ESTABLISHED 1905

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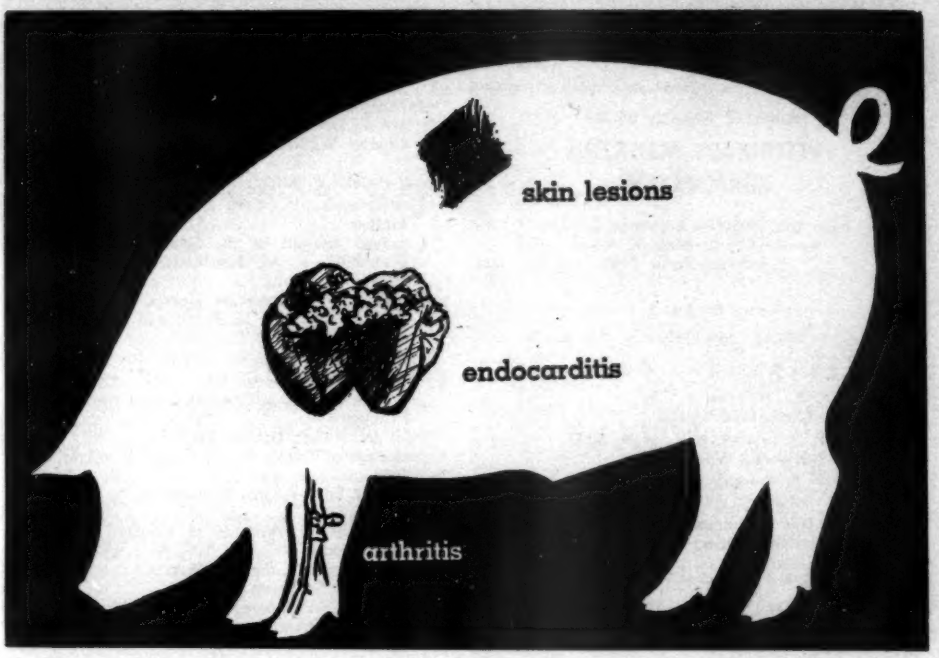

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VETERINARY MEDICINE

A Monthly Magazine Devoted to the Promotion of the Art and Science of Veterinary Medicine

Vol. XLIX JUNE 1954 No. 6

Published Monthly by the
VETERINARY MAGAZINE CORPORATION

Suite 803, Livestock Exchange Building
Kansas City 2, Missouri, U.S.A.
Telephone: Victor 2985

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SUBSCRIPTION RATES. One year, $5.00; two years, $8.75; three years, $12.00. Single copy, 50c. U. S. Funds. Postage prepaid. Authorized agents will present letter of collection authority. Pay no money to others.

Entered as second class matter at the post office at Kansas City, Missouri. Entered as second class matter under the title of the American Journal of Veterinary Medicine, July 19, 1910, at Chicago, Illinois, under the Act of March 3, 1879.

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AUTHOR-CONTRIBUTORS: Articles submitted for publication are accepted as original communications and with the understanding that they are not submitted to other journals. Manuscripts should be clearly typed, double spaced with wide margins, and sheets numbered consecutively. See prior issues for style. Tables and charts should be simple and clearly illustrate the text material.

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Rumen Sampling: A Diagnostic Aid†

W. D. POUNDEN,* D.V.M., Ph.D., Wooster, Ohio

THERE are times, when confronted with the task of making a differential diagnosis in ruminants, that one could well afford to do without the usual diagnostic aids sooner than forego the opportunity of examination of a rumen sample. It is the rumen, with all its varied activities, that makes a ruminant different from other animals. It is logical, therefore, to check the condition of the contents of this organ when one is confronted with an anomaly of unknown cause in these animals.

Many diagnoses would be difficult without the assistance of various examinations such as those involving milk, blood, urine, or feces. Indications for their conduct are provided by the clinical signs and results often reveal existence of a particular pathological state or suggest a rational approach for the treatment. Information gained from conduct of these inspections is by no means always on the positive side as far as abnormalities are concerned. This, in itself, is not of course, a mark of inadequacy or that time was wasted because the finding of a normal situation directs attention to other conditions. Besides this, unnecessary and sometimes detrimental treatments are avoided. Rumen sampling may be placed in a similar category. Considered in this light there is good reason to believe that examination of rumen contents has not received the attention it deserves as a diagnostic aid in cattle practice. This becomes all the more apparent when note is taken of the relatively high frequency with which calls are received to care for these animals that involve conditions of rather vague symptomatology and inadequate histories, especially concerning feed and management.

Collecting Rumen Samples

Stomach tubes of various sizes are used to collect rumen samples for examination and for larger quantities for inoculation and transfusion. The technic used in passing tubes has been described in some detail[2,3,4] but reference to it here may not be out of place. We prefer relatively stiff rubber tubing and keep it coiled while not in use to help preserve its curved form. This facilitates passage past the tongue and also is of considerable assistance in steering the end into the desired locations. Tubing that is approximately ½ in. in outside diameter and 3 ft. in length works well in small calves, while, for older animals, tubes varying in size up to the large Colorado tube are recommended. The length of the latter may be as much as ten feet. A smooth-walled water hose 7½ ft. long is satisfactory, or automobile heater hose 6½ ft. long serves well. A speculum other than one's gloved hand is unnecessary in young stock, but in older animals the type made from a block of wood often is advantageous. The animals mouth, preferably, should be free of feed. A small quantity of oil is applied and the tube held so that the curve tends to point the end somewhat dorsally. This makes it easier to get past the prominence on the back of the tongue, keeps the tube dorsal to the larynx and directed into the region of the esophageal opening above it. Little pressure, if any, is used in entering the esoph-

†Presented at the Ohio State Veterinary Medical Association meeting, Columbus, January 7, 1954.

*Veterinary Science Dept., Ohio Agricultural Experiment Station.

agus. The tube is passed into it in synchronization with a swallowing motion. It may then be gently passed on down the esophagus. If friction is encountered the tube should be withdrawn somewhat and again passed on down, as this helps to spread the oil and saliva. At times the esophagus can be opened to advantage by blowing down the tube. The tube can be turned over on its axis and otherwise moved until it is located where desired. Once well inside the rumen, it generally is satisfactory, for sampling purposes, to turn the tube over so that the outside opening points toward the floor. When properly located, a back-and-fourth motion of a few inches to a foot causes a gurgling sound as the tube splashes in the liquids. The same motion encourages contractions and flow of liquid portions of the contents out through the tube. It is unnecessary to keep up continuous motion of the tube. In fact, in collecting larger quantities it is well to pause frequently in order to permit liquids to be replenished around the tube end by rumen movements. When liquid quantities are low, some assistance can be obtained by upward pressure in the lower left abdominal region. Withdraw the tube gently.

Fig. 1. Stiff rubber rumen sampling and lavage tubes with wooden speculums. The three larger tubes are automobile heater hose, heavy duty water hose, and a Colorado tube.

If friction is encountered, the direction is reversed a short distance before proceeding. The time required to collect a sample seldom exceeds a few moments and even large quantities often can be obtained within five minutes.

Information of diagnostic assistance obtainable from rumen sampling can be subdivided into three parts: (1) Observations of a physical nature from passage of the tube, (2) from macroscopic examination of the rumen sample, and (3) from microscopic examination.

Diagnostic Information Through Passing Tubes

Where animals have been unable to properly extend their tongues we have experienced some difficulty in passing the tube. The explanation seems to be that in relying on the swallowing action to take the tube into the esophagus, without force, the animal must extend the enlargement on the back of the tongue to clear the passage. In the absence of this cooperation we naturally check for obstructions, injuries, infections or paralyses.

Fig. 2. Passing a Colorado rumen lavage tube.

There have been instances where symptoms exhibited were suggestive of partial or complete choke and it has been gratifying to have a technic for quickly checking the situation. It was a relief to find a clear passage on some occasions, and on others to be able to locate the offending mass.

It is doubtful if anyone knows all the possible causes of repeated bloating in ruminants, yet without some idea of the etiology in individual cases it is difficult to arrive at the type of treatment likely to be effective. Passage of tubes in these cases often provides helpful information. For instance, it was noticed, in one steer, that it was nearly impossible, at times when the animal was bloated, to pass the tube through the region of the diaphragm and cardia. Ration consisted largely of ground corn-and-cob meal and included quite a little fiber from husks. It was surmised that matted bunches of the undigested fibers had formed plugs in the cardia when the animal attempted to ruminate, the bolus being too bulky to be properly regurgitated. This explanation was suggested by observations made during studies of hair and fiber-ball formation in young calves. In contrast to the above case, difficulty was not experienced in passing the tube into another animal that bloated repeatedly. Furthermore, examination of a rumen sample indicated some lack of

moisture but showed it to be quite normal in appearance and also insofar as the microorganisms were concerned. Thus another form of mechanical obstruction or malfunction was suspected. Later, on autopsy, it was found that this may have been true because there was great enlargement of the retropharyngeal lymph nodes. Evidently the tube had been able to push past the swollen glands even though they were pressing sufficiently hard on the esophagus to prevent regurgitation and release of gas.

A firm mass in the rumen that resists passage of the tube down to its floor and forces it up into the flank region where it can be felt has been observed in animals that have not been drinking and ruminating properly. Some have been affected with sore throats. Collection of anything but a small sample has been difficult in these circumstances until warm water was given.

On the other hand, passage of the tube has been met by gushing out of rumen liquids even before the tube gets all the way into the rumen. This has been the usual finding when animals have not been eating for some days. The freedom of the liquid from foodstuffs would cause one to surmise that rumen digestion had continued after ingestion stopped. It should thus indicate the original cause of inappetance was not the rumen itself and this seems to be the case. This condition has been observed, for example, in animals that have been slow to recover from acetonemia, have been ill due to liver abscesses, or were suffering from paralysis of the organs of prehension. Experiments with calves have shown that a flooding of the rumen with liquid usually occurs before they begin eating solid foodstuffs or when denied these rations[6]. Contrary to the opinions of some, these liquids must come from the rumen wall as they are devoid of the buffering capacity that is associated with saliva.

Diagnostic Information from Rumen Sample

The appearance and odor of the sample have provided helpful information on many occasions. These vary with the feed that has been eaten but this has not proved to be a problem of consequence after some experience was gained. Recently eaten feed often has appeared excessively dry and a few hours after feeding the reverse has been true. Here again experience has helped considerably. Odor often has provided the answer. Contrary to the remarks one reads and hears, the normal,

Fig. 3. Masses of protozoa settling out of rumen sample in test tube.

volatile, fatty acid odors of rumen contents taken from animals eating usual rations, consisting in large part of roughages, are not offensive. True they are different and to the unitiated may at first seem offensive, but once really offensive ones have been encountered opinions change. For example, the appearance of a sample from a cow suffering for a day or so from complete inappetance and with a history of having eaten moldy hay was relatively normal but it had a distinctly abnormal, acrid odor. The same was true of that from a young heifer that became seriously affected after eating heavily of forage crop silage without previously being fed this kind of feed. It was surmised that the fermentation taking place was abnormal and that toxic substances were present. The deduction received further support when the sample from the younger animal was examined microscopically and a markedly abnormal flora was found to exist.

A common finding has been an excessive amount of grain, and sometimes a frothy mass composed of this and other materials. Odors have been offensive at times and seemed to depend, to some extent, on how long the animal had been sick. One herd had lost several of its better calves, as they reached approximately six weeks of age, when we first got a chance to examine one. Its rumen sample was of the type just described and the animal evidently was in serious condition. A check with the owner indicated that little or nothing but milk had been fed until a few days previous when a liberal amount of corn-and-cob

meal had been provided. A somewhat similar type of case was presented by a nine-month-old heifer being fitted for sale. Some others had died previously with similar symptoms. This animal had failed to respond to a number of treatments and rumen sample gave ample evidence of what some of these consisted.

Samples have been collected from animals that had been sick for days following acetonemia where chaff, bedding, dirt, and drugs were present in a frothy mass, but little or nothing resembling normal feed could be seen. As would be expected, microscopic examination has shown an absence of usual microorganisms. Some information recently has been provided by Michigan State College workers[7] concerning a cause of some of the frothy masses that develop in rumens. They demonstrated that mixtures of certain grain rations with a little hay would produce a frothy condition. The same physical laws may apply to similar problems where different feed and materials have been ingested.

Another type of abnormal rumen content that is easily picked up by sampling is milk or milk curd in young calves. Our work with calves has indicated that milk may enter the rumen during the first four days of age without a truly pathological condition existing, but at

Fig. 4. Photomicrograph of rumen protozoa.

a later age it generally means trouble[8]. The tendency has been for curds and watery, sour-smelling liquids, sometimes accompanied by bits of shavings, chaff, straw, or grain to be present as the age of the calf (when it got sick) advances. Our studies have led us to deduce that the curd particles and whey-like fluids are vomited up from the abomasum because of the existence of gastritis.

Common sense would caution the use of rumen sampling where traumatic gastritis is evident. However, in one instance, when blood clots came out of the tube in a cow in which the diagnosis was not readily apparent, the matter was soon clarified. So far, we have not made a diagnosis of poisoning by using rumen sampling as the principal aid. It would appear, however, that this could happen where quantities of insecticide dusts and sprays, having insoluble components have been eaten. Some of these materials have characteristic colors that help identify them. We have noted, too, at autopsy that some of these products settled down in the more liquid portions of the rumen where most rumen samples are obtained.

Diagnostic Information from Examination of Microorganisms

There are two main groups of rumen microorganisms, protozoa and bacteria. It is possible to see individual, larger protozoa with the naked eye and to distinguish readily masses of them in rumen contents as they sift out to the bottom of glass containers. In freshly drawn samples, the individuals appear as small, light colored particles resembling in size the tiny bubbles which usually are present. They differ, however, in that their motion is erratic in all directions whereas the bubbles only move in one, upwards. Thus a quick check of the presence or absence of these organisms, and to some extent their relative activity, is possible even without a microscope. We have used this method of observation to advantage as a rough estimate in field cases of whether calves have had an adequate opportunity to obtain rumen inoculations. The presence of protozoa apparently is indicative that the animals have had a chance to pick up more desirable types of bacteria but we have noted, on occasion, that it was not completely reliable. Then again some of the protozoa can withstand greater concentrations of grain than can some of the desirable bacteria and thus may prove misleading when much grain has been fed. When numbers are few it is almost imperative to examine a drop of the liquid under a microscope in order to detect their presence.

Although it is possible to detect in fresh, wet, microscopic preparations some of the large bacetria that are characteristically present in rumens of animals on usual rations, we generally resort to Gram-stained slides. The particular microorganisms which we have used as indicators of the presence or absence of usual varieties have been described in some detail[3,5]. They consist of Gram-positive large

coccoids, Gram-negative large cigar-shaped organisms having numerous striations, Gram-positive fairly square-ended rods, having a tendency to form in pairs, and small Gram-negative rods that form in flat groups or rectangles like window panes. Another fairly large Gram-positive rod frequently has been noted to become established in uninoculated and segregated calves but disappears following adequate inoculation. Its presence, therefore, is indicative that only a substitute flora is present. Examination of smears for these organisms was found to provide a satisfactory method for estimating the status of rumen inoculation. It has been possible to use the method for indicating the relative proportions of hay to grain that has been eaten provided it was known that repeated inoculations had been given because some of these organisms fail to become established when the quantity of grain ingested is proportionally high. It also has been observed that the feeding of aureomycin supplement to calves inhibits some of these indicator microorganisms[1]. Some animals suffered set-backs when this product was taken out of the ration at a time when the calves were dependent more on hay than grain. Examination for these organisms in smears from calves of this type provided a means for indicating the proper diagnosis and directing the logical reinoculation treatment.

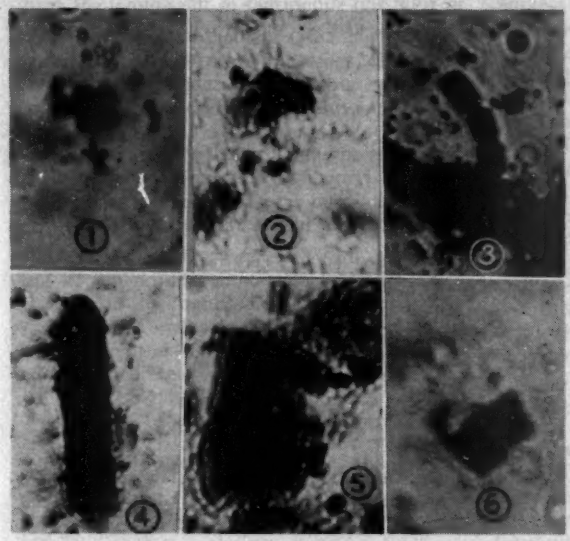

Fig. 5. Photomicrograph of rumen microorganisms (approx. X 1800). 1 & 2. Large Gram-positive coccoids; 3. Gram-positive fairly large square-end rods; 4. Large gram-negative cigar-shapped organism; 5 & 6. Small Gram-negative rods in flat groups.

Risks and Precautions in Rumen Sampling

A few remarks may be in order concerning possible dangers that may exist in the operation of rumen sampling even though the risk is small. It is likely that the pharynx and the esophageal opening would be irritated if the tube is forced instead of synchronized with swallowing movement. The point most likely to be injured by an excessively large tube is the posterior end of the esophagus. Irritation or laceration of the posterior walls of the rumen would be possible if the end of the tube is bumped hard or repeatedly against it. In the presence of a penetrating lesion caused by a foreign object in the reticulum, extra contractions stimulated by the tube could add to the quantity of leakage into the peritoneal cavity. It should be possible to cause some inhalation of rumen contents and choking where contents were forced up the esophagus around the tube at a time when the animal's head was held up high. During the stronger contractions of the abdomen, fibrous portions of rumen contents may ascend around the tube and become locked against it by esophageal spasms. If it is desired to remove the tube when this occurs it probably is more advisable to push the tube back down a short way before pulling out as this seems to free it.

Summary

Wider use of rumen sampling as a diagnostic procedure should assist materially in improving and simplifying the differential diagnosis of various problems of ruminants. Furthermore, it is probable that should veterinarians,

(Continued on page 228)

Stomach Parasites Of Cattle†

A. M. MILLS,* D.V.M., Athens, Georgia

PARASITES cannot be controlled successfully when treatment is started after the appearance of symptoms. Treating heavily parasitized animals gives one a feeling of helplessness and defeatism. Light infections can be cured or kept to an economic minimum if farmers heed advice. Understanding of the ravages of intestinal parasites is sadly lacking, for the greater percentage of cases presented at the Georgia clinic are those in which parasitism is advanced, and evident clinically. We know that many farmers try to get by without using proper treatment and in many cases have not learned that cattle are subject to parasitism and that management practice must take this factor into account. It is the old story of needing more education.

Boughton, speaking at Clemson last year, stated that ten parasites per animal, sucking 0.8 cc. of blood a day, would remove six pints of blood a year from the host. Applying this as an average, 500,000 cattle in South Carolina would lose 3,000,000 pints of blood in a year. The food necessary to produce a pint of blood in concentrates, hay, and pasture, actually costs approximately $0.30 per pint, or a total of $1,000,000. a year—the estimated cost of bovine parasites in South Carolina, which has less cattle than any other state in the South. This is based on an average of only ten adult parasites per cow; actually most have many more. The loss is almost beyond accurate estimation. I can think of no better way to show a farmer what happens than to perform a careful autopsy on one of these heavily parasitized cows to illustrate the difficulty of removing parasites buried in the intestinal wall with any treatment available.

For the last several years, cattle which exhibit symptoms of anemia, scours, anorexia, emaciation, and staggering from parasitism, have been brought into the Georgia clinic for diagnosis and treatment with owners insisting that they be treated. Many have been dosed with phenothiazine, after symptoms have appeared. What a job of education we have ahead of us.

For illustration, two cows were presented recently having the following history: Veterinarian called August 10 to treat five cows exhibiting diarrhea which the owner said had appeared overnight. Herd of 75 on pasture. Four of the five were eating and all had a watery diarrhea. Temperatures were normal in four and subnormal in the animal off feed. This cow died soon.

On this visit they were treated for forage poisoning and dosed to check the diarrhea. The four remaining cows were isolated the next day. Sick animals were observed on several occasions and treated with different antidiarrheal remedies. Nothing proved effective. The owner tried several remedies suggested by his neighbors with no results.

During this time cows continued to eat. None exhibited pain or depression but all lost weight. The state veterinarian's office was called for blood and fecal examinations. They reported anaplasma-like bodies in the red blood cells. Fecal examination was negative. On October 18, another cow died. Specimens received from this animal revealed heavy parasitism.

On October 19, two of the remaining five was presented at the clinic. Both exhibited extreme emaciation and fluid diarrhea. Fecal samples revealed 4+ for Ostertagia spp., Hemonchus, and smaller numbers of Trichostronglyus. One animal died three days later; the other is improving slowly under treatment to be outlined later.

Autopsy revealed severe emaciation, anemia, thickened walls of the abomasum, small intestine with edema. Scrapings from the mucous surface of the stomach revealed large numbers of all common stomach worms. No evidence of anaplasma bodies were found in either cow.

It does not seem possible that fecal examination made on the cows at the farm should have been negative unless the extreme diarrhea had flushed out parasite eggs. Sulfonamides administered earlier aggravated anemia.

Ostertagia inhabit the abomasum almost exclusively. Thickened walls are noted to be ½ to 1½ in. thick, have a pale pink, moist ap-

†Presented at the 38th annual meeting, Southern Veterinary Medical Association, Nov. 9-11, 1953, Atlanta, Ga.

*Associate Professor, Clinics and Medicine, School of Veterinary Medicine, University of Georgia.

pearance and appear to be covered with tiny flakes or shiny scales or plaques on the swollen mucous surface. When the surface is squeezed, fluid oozes out. In heavy infestations, adult parasites will be found by examining scrapings of the mucous surface under the low power microscope. These little blood-suckers are voracious feeders and will bleed a cow-host to death.

The Trichostronglyus may inhabit the abomasum and the small intestine but are found mostly in the walls of the small intestines. The single species in the abomasum are the most important and cause the most trouble. They may be observed in scattered areas of the small intestine, suggesting that scrapings must be taken in five or six different areas. Larvae of both these species of worms are buried in the walls of the swollen intestine that protects against anthelmintic action.

Treatment recommended is 8 to 16 oz. of a 1% copper sulfate solution. For weak animals use one-half the dose one day and the other half the next day. Repeat treatment in ten days. Another satisfactory schedule is to treat with 2 to 6 oz. of a 0.5% solution of copper sulfate twice a week for four to six weeks. Copper sulfate has some hematopoietic value. A treatment suggested by a Florida vetinarian is as follows:

R_x

Ferric Ammonium Citrate	0.5 lb.
Copper Sulfate	20 gm.
Cobalt	10 gm.
Water q.s.ad.	1 gal.

M. ft. sol.
Sig. 2 to 6 oz. twice weekly for four to six weeks.

Phenothiazine gives best results in cases of common internal parasites of cattle. The system of using a mineral mixture in self-feeders consisting of three parts each of ground limestone, bone meal, and salt and one part phenothiazine, by weight, is excellent, but boxes should be placed in the shade and scattered to assure availability to all animals of the herd. These containers also should be protected from rain.

Confusing Symptoms of Parasitism

Many parasitized cows exhibit a suspicious thickening of the skin along the sides of the neck and under the axilla. Skin is thickened, scuffy, and wrinkled, suggestive of hyperkeratosis. On autopsy of such animals, ulcers are observed in the mouth and esophagus. These lesions of hyperkeratosis usually are not advanced but liver and bile duct reveal typical and unmistakable lesions.

This syndrome appears to be caused by the edema and swelling of the intestinal walls which hinders absorption and interferes with the conversion of carotene to vitamin A. It is known that hyperkeratosis either destroys vitamin A in the body, or the lack of vitamin A may be manifested by lesions similar to those of hyperkeratosis. It is quite possible that misdiagnosis of hyperkeratosis is being made and parasites overlooked.

A cow with a severe diarrhea of several weeks standing, full of parasites and not eating, is starving to death. Doctor Kingma of Ohio State College has called attention to the fact that animals with long standing, persistent diarrhea are deficient in potassium. In the few cases where potassium chloride has been added to intravenous dextrose, encouraging results have been realized. The product is potassium chloride solution (Abbott), which carries 3 gm. KCL per vial. This is added to 1,000 cc. of 10% dextrose. Repeat daily for three days. Administer solution slowly to avoid muscle tremors. The rapidity of injection, and the concentration of dextrose for intravenous use, is important. Dextrose and stimulants administered when an animal is nearly down is good treatment if not abused. To give an anemic, dehydrated, depressed animal a bottle or more of 40 to 50% dextrose results in further dehydration and the dextrose is wasted by spilling over the urinary threshold. Few veterinarians spend over ten minutes giving a bottle of dextrose no matter how concentrated. The greater the concentration and the faster the injection, the more is lost. A dehydrated cow should be given a solution of 10 to 15%, and certainly not over 20%, slowly. We have proved, by taking samples of urine during injection, that in giving a 500 cc. bottle of 20% dextrose within ten minutes, much of it appears in the urine and is lost.

The statement was made not long ago that, "the success of all animal husbandry is more dependent on the elimination of the cause of trouble than in trying to salvage what is left after disease strikes." That means prevention. Before I came to Georgia I was chairman of the State Livestock Disease Prevention Committee, originally organized to meet the need for farmer education in disease prevention.

There is no doubt that the best client of the practicing veterinarian is the educated livestockman. The educated animal owners know that the proper person to treat animals is the

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Rumen Sampling

(Continued from page 225)

through this experience, become personally familiar with rumen microorganisms, their activities and the technics used in studying them, some treatments and products presently advocated would receive much more critical appraisals and new approaches would be developed.

REFERENCES

1. Hibbs, J. W., Conrad, H. R., and Pounden, W. D., The Effect of Feeding Aureomycin Supplement on the Performance of Calves Raised on the High Roughage System. (In press).

2. Kingman, H. E., Gastric Lavage in Cows. *Jen-Sal Jour.*, (May), 1931.

3. Pounden, W. D., Some Factors Affecting Rumen Function in Young Dairy Calves and Their Influence as Reflected in the Health of the Animals. Thesis, Ohio State University, 1949.

4. Pounden, W. D., Rumen Function and Health in Young Calves. *Proc. Am. Vet. Med. Assn.*, 1952, pp. 40-43.

5. Pounden, W. D., and Hibbs, J. W., The Influence of the Ration and Rumen Inoculation on the Establishment of Certain Microorganisms in the Rumen of Young Calves. *Jour. Dairy Sci.*, 31:33, 1943.

6. Pounden, W. D., and Hibbs, J. W., Rumen Inoculations in Young Calves. *Jour. Am. Vet. Med. Assn.*, 114:33, 1949.

7. Smith, C. K., Brunner, J. R., Huffman, C. F. and Duncan, C. W., Experimental Production of Frothy Bloat in Cattle. *Jour. An. Sci.*, 4:932, 1953.

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Parasites of Cattle

(Continued from page 227)

graduate veterinarian. The more the owner studies and learns the better equipped he is to recognize trouble and appreciate the dangers of delay. He may assist a cow in calving, but he knows his limitations and the value of disinfection. He calls his veterinarian at the proper time. He knows he cannot take chances on disease and he does not listen to unqualified advice.

There is little use trying to educate persons who believe in hollow horn and wolf in the tail, but education of boys through the 4-H, F. F. A., the high school, and other organizations will make our farmers of the future conscious of the value of good care. High school teachers, county agents and extension service men welcome help from the veterinarian. Things which can be done as educational projects for growers of livestock should concern us, as disease control specialists. I suggest, for example, the establishment of a library of lecture material in the office of the secretary of each state association here represented, as a source of subject matter available to practitioners for discussions before lay groups. Perhaps Control of Parasitic Diseases of Cattle might be a worthy subject with which to start preparation of such library facilities.

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Missouri Veterinary Registration

Under provisions of the new veterinary practice laws, all veterinarians now holding licenses to practice in Missouri and who desire to maintain these licenses in good standing must register for renewal with the Missouri Veterinary Board prior to June 30, 1954. Application blanks for license renewal may be obtained from Dr. L. A. Rosner, chairman, Missouri Veterinary Board, P. O. Box 630, Jefferson City, Mo.

All licenses not renewed as provided above shall become delinquent, and any veterinarian who shall be delinquent for a period of 60 days shall forfeit his license to practice.

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Noisy cages may be responsible for fur chewing in chinchillas.

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California Amendment to Scabies Regulations

Amendment to California Cattle Scabies Regulations adds two additional states, Kansas and Oklahoma, to the previously announced list including Arizona, Colorado, and Texas designated as infested with cattle scabies.

An official health certificate and a California permit are required for shipment of feeding, breeding, and show cattle from these five states.

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Opposition by antivivisectionists who have fought recently proposed pound ordinances in a number of widely separated areas, appears to be based on the fanatical belief that rabies is nonexistent among dogs.

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The Bureau of Labor Statistics is authority for the conclusion that it required fewer working hours to buy given units of dairy products in 1953 than in any previous period during the last 14 years; their high cost notwithstanding.

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It is a good precaution to get both sows and their litters used to green forage before moving them from a central farrowing house. Green feed may be cut and brought to the pen each day for a week before moving.

Foreign Animal Diseases: A Threat To The Livestock Industry†

FRANK A. TODD,* D.V.M., Washington, D. C.

Not long ago exotic animal diseases of the Old World were regarded as problems peculiar to the areas where rampant. Today problems of containment, prevention of entry, control and eradication, challenge officials.

Dangerous foreign animal diseases have gained entrance into the United States during recent years in spite of barriers erected against them. Eradication measures in each instance were effective. The presence of some of lesser importance has become known lately. Considering modern methods of transportation and marketing, and susceptibility of the animal population, highly communicable exotic disease may become widespread initially, and prove devastating.

It is therefore of vital importance that all be seriously concerned because of the existence of potential hazards.

PRODUCTION of livestock and poultry is not always a profitable undertaking. Disease constitutes a major hazard. Always present, it can bring about sudden and crippling losses. In spite of this, the national livestock industry has been able to supply foods of animal origin in quantities sufficient to assure a high standard of nutrition for enjoyment and health of our population.

The situation in the future is likely to provide some complicated problems. It appears that livestock producers may have difficulty in meeting food demands of an increasing population. By 1975, the population of the United States will have increased from 160,000,000 to an estimated 190,000,000. If this be true, in order to maintain current nutritional standards, present livestock and poultry resources must be increased substantially. This will be difficult to accomplish because, with necessary increased numbers of food animals, the disease factor is expected to become more significant. Livestock owners will be required to improve their methods of operations. They will depend more and more upon expert consulting services to furnish specialized and technical help needed to control disease. Veterinary medicine faces a terrific challenge.

Should a highly fatal disease suddenly appear and spread beyond control, tragedy would beset this effort, since the present level of disease must be reduced if future food demands are met. An important problem that must be solved is the protection of livestock and poultry against foreign diseases. Many of these are highly fatal and, if allowed a foothold, could become established in this country. Although in the past these diseases have been excluded with a fair degree of success, two new factors are rapidly changing the picture: (1) Rapidly increasing worldwide transportation and travel—a result of the expanding technology characteristics of the times, and (2) possibilities of sabotage.

Foreign animal diseases that might gain entrance into this country either by accident or by deliberate acts of sabotage could quickly become widespread among livestock and poultry unless they are recognized promptly, and immediate measures taken to combat their introduction and establishment.

Successful control of any disease depends upon: (1) Prompt detection and reporting, (2) accurate diagnosis, (3) knowledge of the epizootiology of the disease, (4) eliminating the causative organism from the host or its environment, (5) isolation and quarantine, (6) and, the development of protective vaccines or successful methods of treatment.

In addition to an understanding of these established principles of disease control, the success of an emergency program for eradication of foreign animal diseases will depend upon the accessibility of necessary personnel, equipment, supplies, and funds with which to conduct an effective program for diagnosis and control. Experience by American veterinarians in research and field work with exotic diseases is especially valuable in increasing their competence to meet emergency situations.

It must be recognized that absolute protection against entrance into this country is impossible. Disease travels as man and his animals travel—as they travel faster, infection does likewise. Today's rapid intercontinental

†Presented at 86th annual meeting of the Southern Veterinary Medical Association, Nov. 9-11, 1953, Atlanta, Georgia.

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air transport, and its fast-growing volume, are increasing the hazards of accidental disease transmission. These same factors strengthen the feasibility of sabotage.

Quarantine, isolation, and import restrictions are important weapons in preventing the entrance of these diseases. Import restrictions, as practiced by the federal government, have been of incalculable value in helping to keep this country free of most dangerous foreign plagues. For the possible consequences that can result from relaxing established import restrictions for only a short period, or for a single exception, one has only to review the early history of the foot-and-mouth disease outbreak in Mexico.

Dangerous foreign animal diseases have gained entrance into this country in the past, and each time have been eradicated. Under modern conditions of marketing and transportation, however, a highly communicable exotic disease might be so wide-spread initially, that the past policy of eradication would be economically unsound. Under such circumstances it might be necessary to resort to slower and less immediately effective methods, including the use of vaccines and other biologics.

Not too long ago exotic animal diseases were regarded as problems peculiar to Africa, Asia, or South America. Experience in the United States during the past year is convincing that foreign diseases can gain entrance into this country, not only those highly communicable but even those requiring an insect vector for transmission.

The appearance of foreign animal diseases in this country poses many problems including lack of experience with it, susceptibility of livestock, and lack of effective biologics. If foreign animal diseases are intentionally introduced, additional problems are presented. Under such circumstances, a single disease or combination of disease agents can be employed simultaneously. Unfortunately, there are a number of animal diseases, native and foreign, benign and fatal, that present similar symptoms, all of which increase diagnostic problems. Again, even if we become acquainted with a given exotic disease, and the phenomena associated with its natural occurence, its willful use by an enemy could involve unnatural means for dissemination, thus posing unexpected situations and compounding the problem. Several illustrations will be discussed.

Vesicular Diseases

The first group of diseases include vesicular exanthema, vesicular stomatitis, and foot-and-mouth disease, all highly communicable. They present identical symptoms and make specific identification based on clinical observations impossible. Laboratory or biological tests must be relied upon for differential diagnosis. Each disease possesses several types or strains and within these strains are variants further complicating diagnosis and control. Mortality in adult animals is relatively low but the presence of these diseases can result in significant losses of meat and dairy products. Abortions and high mortality among young animals result from these infections.

We must be concerned seriously with each outbreak of vesicular disease in this country, whether vesicular stomatitis or vesicular exanthema is suspected, because there exists the hazard that each such outbreak may be masking foot-and-mouth disease.

Blue tongue is another disease with similar symptoms which can be added to this group. It was initially called "pseudo-foot-and-mouth-disease" when first found in cattle[1]. Lesions for the two diseases are similar in the later stages. Blue tongue is characterized by its confinement to specific localities, by its seasonal and sporadic occurences, by its failure to spread through contact, and by inability to trace the source of infection. Its incidence in cattle is low as compared to foot-and-mouth disease.

A disease known as "erosive stomatitis in cattle" was reported in Natal, Africa in 1938[2] following an eradication program for foot-and-mouth disease. It is caused by a virus. Associated lesions closely resemble those of foot-and-mouth disease. It was distinguished on the following clinical grounds: (1) Absence of truly irregular, jagged erosions, (2) absence of high degree of vascularity of lesions, (3) no "hotness" of the mouth and no copious salivation, (4) absence of foot lesions, (5) absence of systemic disturbances, (6) apparent confinement of condition to stock under three years of age and its failure to assume epidemic proportions.

The disease appears to be of no economic importance but its presence confuses diagnostic problems.

Rinderpest

A second group of diseases with similar symptoms include rinderpest and virus diarrhea of calves. Rinderpest can be confused readily with virus diarrhea of calves as described by Olafson of Cornell University in 1946,[3,4,5] and with the mucosal disease of cat-

tle more recently described by Ramsey of Iowa State College[6].

The virus diarrhea as described in New York state is an acute, contagious, transmissible disease of cattle. Animals can be infected with this disease in a mild form that may go unnoticed. The disease may vary from this form to a severe type closely resembling rinderpest. Animals with an extremely mild form of infection can act as carriers. The New York disease is readily transmitted and can be carried from farm to farm unless preventive measures are observed.

The Ramsey report describes a severe type with few, if any, mild cases observed. An intermittent watery diarrhea, sometimes mixed with blood, profuse salivation, emaciation, dehydration, and depression are present in almost all cases. Initially there is elevation of temperature to about 106 F. lasting for 24 to 48 hours, then rapidly dropping to normal. There were no central nervous symptoms observed. The course of the disease is three to ten days. Erosive and ulcerative lesions of varying size and shapes were found in the nostrils, muzzle, lips, gums, tongue, oral cavity, and alimentary canal. A foul smelling, mucopurulent exudate hung from the nostrils and muzzle. Both beef and dairy types, six to 14 months of age, were affected.

Differentiating virus diarrhea from rinderpest is difficult. Rinderpest, in a highly susceptible animal population, has an extremely high morbidity and mortality rate. It infects and causes great losses of sheep and goats. This has not been the case with virus diarrhea. Serum neutralization tests and animal inoculation tests can be used to confirm a diagnosis.

Swine Fever

A third group of diseases presenting similar symptoms include hog cholera, swine erysipelas, certain nutritional deficiencies of swine, Teschen disease, and African swine fever. Teschen disease[7] is a virulent, contagious, encephalomyelitis of swine, characterized by manifestations of a cerebral and medullary nature. It is caused by a filterable virus. It has become a serious problem in the swine industry of several eastern European countries. The epizootiology is not well known and control measures are not well established. The Federal Civil Defense Administration and the U. S. Department of Agriculture have cooperatively developed a sound movie entitled, Teschen Disease — Symptomatology Contrasts with Hog Cholera and Nutritional Deficiencies. The movie describes Teschen disease in swine and illustrates symptoms produced by the virus of this infection and various manifestations infected animals exhibit. The film points out those symptoms of nutritional deficiencies due to calcium, phosphorus, vitamin D, vitamin A, and pantothenic acid, and unusual variant of hog cholera[8] that might be confused. In differential diagnosis, it is wise to study the feeding habits of the suspected herd to determine what place inadequate diet may have in the existing condition. The incubation period for Teschen disease varies from seven to 15 days in contrast to the much shorter period in hog cholera. Teschen disease is confined to the central nervous system causing symptoms of a meningoencephalomyelitis. At times this diseases may appear sporadically within a herd of swine, while at other times morbidity may vary from 35% to 90%. Attacks may be sudden and widespread in some herds while in others several weeks or even months may elapse between exposure and apparent infection. The frequency of recovery in Teschen disease is about 20%, however, paralytic symptoms rarely disappear. This recovery rate is in striking contrast to that of hog cholera.

African swine fever[9,10,11] is a form of swine fever (hog cholera) of a particularly virulent character usually manifesting itself in the form of an epizootic. It has been reported by workers in East and South Africa. Although its symptoms and pathology closely resemble American hog cholera, there are differences. Experiments in the injection of pigs immunized to hog cholera with blood from cases of African swine fever resulted in 100% mortality. Similar results were experienced when hyperimmune pigs were exposed. Hog cholera antiserum of either European or American origin provided no protection against virus of this disease.

Warthogs infected experimentally with the virus of East African swine fever did not develop symptoms but continued to harbor the virus in their blood. Normal appearing warthogs and wild hogs from infected areas harbored the virus of this disease.

Rift Valley Fever

A fourth group of diseases of this type includes: Enterotoxemia, vibriosis of sheep, bluetongue, Q fever, and Rift Valley fever. Rift Valley fever[13,14,17] is an important viral disease of man as well as of domestic animals. Because man and animals are equally susceptible to it, it presents a public health problem similar to Q fever. Although Rift Valley fever is transmitted by mosquitoes, it is now clear

that it can be spread by direct contact.

Rift Valley fever produces an influenza-like infection in man. Reports[13] state that veterinarians who have conducted portmortem examinations on animals infected with Rift Valley fever have become ill. The same applies to farmers who have attended infected herds and flocks. Butchers, delivery boys, and housewives who handled infected meat that had been inspected for human consumption, became ill. Cows artifically infected produced infected milk; during this period no symptoms were present in these cows except a transient fever and slight drop in milk production. Rift Valley fever has a rapid course, is highly fatal in lambs, pregnant ewes and cows, and is associated with high abortions. The virus is not killed by freezing but is destroyed by pasteurization. In some human cases there are serious eye complications, such as detachment of the retina, but ordinarily the course is approximately four days. Clinically, it must be differentiated from the above listed diseases. High morbidity and mortality rates, especially in lambs, and high abortion rates in ewes and cows particularly if an influenza-like disease occurs in those persons who have been associated with infected animals or material, are suggestive of Rift Valley fever. A definite diagnosis can be made by serological means, serum neutralization, and particularly, complement fixation tests.

"Epivag"

In considering the group of diseases related to bovine sterility there is a dangerous disease found in South and East Africa known as infectious or epizootic infertility of cattle, or infectious bovine cervicovaginitis and epididymitis,[14,15] commonly referred to as "epivag." It is an insidious infection of the genital organs of breeding cattle, characterized by a thick, tenacious, mucopurulent discharge from the vagina, or fibrosis and induration of the epididymis and testes. It is transmitted naturally during the act of coitus, and frequently results in complete sterility. The disease is believed to be one of the most serious diseases of breeding stock known to veterinary science. The causative agent is unknown.

In the bull the first sign is a slight, palpable enlargement of the spermatic cord and a puffiness of the epididymis. The enlargement spreads downward eventually involving the testicles. Sexual desire in the bull remains unimpaired in early stages but fertility may be lost before there is clinical evidence of disease. Sometimes a bull may actively continue to serve in spite of advanced lesions. Eventually, libido and potency is lost. Approximately 25% of infected cows become sterile. This depends upon the extent of involvement. If the disease is localized in the vagina, early treatment may prevent sterility, but a sub-clinical form may persist. If the disease extends into the uterus and fallopian tubes, permanent sterility follows. This disease, of course, might be overlooked and diagnosed as one of several breeding ailments now recognized in this country.

Summary

The veterinarian is responsible for recognizing new diseases among the livestock in his community. This requires keen observation and adequate knowledge of the various foreign animal diseases. Information on these has not been readily available in this country. We need more material on this subject.

The United States Livestock Sanitary Association, United States Department of Agriculture and the Federal Civil Defense Administration are cooperating in developing essential information on those little-known plagues that are considered as potential threats to the livestock industry. Some material has been distributed by the USDA. The Federal Civil Defense Administration with the cooperation of the USDA have acquired and developed several sound movies. More are in the process of production. These films are available for limited distribution to veterinary colleges and veterinary meetings. The Committee on Exotic Animal Diseases of the U. S. Livestock Sanitary Association is developing information on specific diseases and related problems with concise instructions on procedures to be followed by regulatory officials and practitioners in event of an emergency. The work of this Committee should provide a basis for an approved and uniform program for control.

REFERENCES

1. Bekker, J. G., DeKock, G. W., Quinlan, J. B., The Occurrence and Indentification of Bluetongue in Cattle—The So-Called Pseudo-Foot-and-Mouth Disease in South Africa. *Onderstepoort Jour. Vet. Sci. and An. Ind.*, 2:393 (April), 1934.

2. Mason, J. H., Neitz, W. O., Erosive Stomatitis of Cattle. *Onderstepoort Jour. Vet. Sci. and An. Ind.*, 15 (July and Oct.), 1940.

3. Olafson, P., MacCallum, A. D., Fox, F. H., An Apparently New Disease of Cattle. *Cornell Vet.*, 34:205 (July), 1946.

4. Olafson, P., Rickard, C. G., Further Observations on the Virus Diarrhea of Cattle. *Corn. Vet.*, 37:104 (April), 1947.

5. Walker, R. V. L., Olafson, P., Failure of Virus Diarrhea of Cattle to Immunize Against Rinderpest. *Cornell Vet.*, 37:107 (April), 1947.

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Aerosol Properties Of Lyophilized Hog Cholera Virus

L. H. SCHWARTE*, B.S., M.S., D.V.M., Ph.D., and JOHN MATHEWS*, B.S., M.S., Ames, Iowa

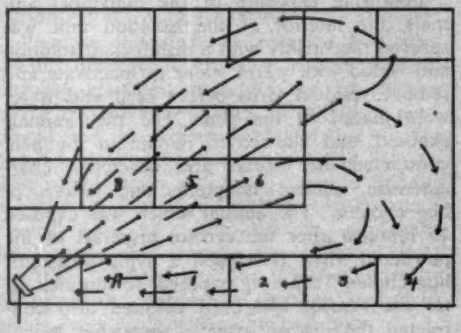
STUDIES pertaining to the transmission of hog cholera, under field conditions, have been carried out for a number of years. The transmission of the disease by contact, as well as contaminated food and water, has been considered as the most common means of spreading the infectious agent. The presence of virus in the secretions and excretions of infected animals was established and confirmed by early investigations. These methods of transmission of the disease did not explain its sporadic occurrence in herds of swine located in isolated areas where the disease had not been reported previously.

Since lyophilization has become an accepted laboratory procedure for the preservation of viruses without materially altering their nature or pathogenicity, the possibility of aerosol dissemination creates new problems. Subsequently it was found that virus, in this desiccated form, retained its activity for long periods under a wide variety of environmental conditions.

Our first experience with aerosol dissemination of lyophilized hog cholera virus occurred about three years ago while we were carrying on some work with the powdered, desiccated virus. The isolation unit consists of a building in which twenty segregated pens were built with solid concrete walls five inches thick and 40 inches high. These pens were 4½ x 6 feet in size with solid concrete floors raised 18 inches above the floor level of the building, equipped with close fitted wooden doors facing the corridor. Each pen contained an individual floor drain in one corner of the pen and a metal trough for feed and water. These pens are easily cleaned and disinfected for experimental purposes. The heat source is a steam radiator suspended from the ceiling in the northwest corner of the building, equipped with a large fan controlled by a thermostat located in the southeast part of the building. The fan circulates the heated air throughout the building. (See diagram).

An experiment lot, consisting of six test pigs and two controls, was set up in the west half of the building. The two control animals were located in the two units north of the experimental pens. The manipulation of the powdered, lyophilized virus was done south of the control pens. One of the controls showed an elevation of temperature on the eighth day, while the experimental swine had their initial temperature reactions from three to five days following inoculation. All of these pigs developed typical symptoms and lesions associated with hog cholera. The course of the air currents generated by the heating equipment was suspected as the cause for infection of the control animal.

Diagram Showing Arrangement of Experimental Animals in Pens, and Air Currents Resulting from Fan.



Heating unit fan
A—Infected control
B—Normal control
1—6—Infected Experimental Swine

This experience prompted the investigation of possible aerosol transmission of hog cholera by lyophilized hog cholera virus. The virus used was a stable strain isolated from a field case. Blood was drawn from an infected pig into a large sterile flask containing glass beads and was defibrinated by vigorous agitation. The defibrinated blood was strained through sterile gauze and placed in pyrex lyophilization tubes. The lyophilization was carried out using the high-speed shell freezing technic[1].

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Experimental Procedure. The aerosol dispersal of powdered virus was carried out in separate isolation units 9 x 11 feet with a 9 foot ceiling. About 10 mg. of finely powdered virus was placed in an ordinary rubber toy balloon. This was attached to the end of a 5-foot length of glass tubing 9 mm. in diameter. Two experimental swine were placed in the animal compartment of the isolation unit and the virus was dispersed in the air by exploding the balloon with compressed air.

An experimental animal was securely bound to a rack. The body and rack were completely covered with a cloth saturated with a suitable disinfectant leaving only the snout of the animal exposed. This cloth cover was designed to prevent the contamination of the body of the animal and the rack. The animal was placed in the exposure pen 15 minutes after the virus was dispersed, and exposed for ten minutes. The animal was removed from the pen, released from the rack and placed in a clean, individual isolation unit. Another animal similarly handled was placed in the isolation unit 30 minutes after the dispersal of the virus, and exposed for ten minutes. This animal was removed and released in another clean, individual isolation unit.

Following exposure of the individual animals, the interior of the isolation unit was sprayed thoroughly with a disinfectant solution and rinsed with warm water to inactivate and remove residual virus before feed and water were placed in the pen. The two animals exposed, and allowed to remain in the pen, contracted the disease and developed characteristic, clinical symptoms and lesions of hog cholera. The animal which was exposed 15 minutes after the aerosol dispersal of the powdered virus developed a typical case of hog cholera. The pig exposed 30 minutes after the aerosol had been released also contracted the disease after a somewhat longer incubation period.

Discussion. The particle size of an infectious agent is a significant factor in air-borne infections. Microscopic examination of the powdered lyophilized blood, thoroughly ground in a ball mill, showed a wide range of particle size. Some of the larger particles included masses of blood cells held together by dried blood serum; the smaller particles were of micron size. Since the particle size of hog cholera virus is calculated to be about 35 millimicrons, virus particles incorporated in dust or other air-borne media many times their size would be well within the aerosol range. It is reasonably well agreed that particles must be of the order of 10 microns or less in size to be suitable for air-borne dispersal. The settling rate of particles in air currents is directly proportional to their size, all other factors being equal. Larger particles incorporating virus in the stroma of the red blood cells, or in masses of desiccated serum, would be much more resistant to destructive agents than unprotected virus particles. Under field conditions dried virus incorporated in dust, straw, or plant fibers would become air-borne under certain weather conditions and cause the disease to be spread to isolated areas.

The exposed animals contracted the infection either through the digestive or the respiratory tract. Further investigations are necessary to determine whether susceptible swine may be infected by way of the respiratory tract.

Summary. A series of transmission experiments was conducted to determine the possible infection of susceptible swine by aerosol dispersal of powdered lyophilized hog cholera blood.

Infection of susceptible swine was accomplished by aerosol dispersal of powered blood in an isolation unit. The aerosol was effective in transmitting the disease at least 30 minutes after the powdered virus was explosively dispersed into the air.

The comparatively small size of the hog cholera virus makes it possible for the virus particle to be incorporated in dust or other air-borne media many times its size and still be well within the aerosol range. The settling rate of the particles in air currents is directly proportional to their size and weight, other factors being equal.

The possibility of hog cholera being spread by air under field conditions to isolated areas was discussed. This may be the mode of transmission of the infection to isolated areas, resulting in sporadic outbreaks of hog cholera.

REFERENCES

1. Schwarte, L. H., Mathews, John, and Parchen, Jr., Frank R., High-Speed Shell Freezing for Lyophilization. *Cornell Vet.*, 42:2, 1952.

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A champion Polled Hereford bull, ALF Battle Mixer 30th recently was sold by John M. Lewis and Sons, Larned, Kansas, to Mr. Otis Smith, Lewes, Delaware breeder for $50,000. Transportation of the 1,710 lb. animal by Trans World Airlines attracted television, radio, and newspaper attention. Airline ticket for the bull was $537.40.

Investigations In The Application Of Pancreatic Dornase In Veterinary Medicine

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The study of the new science of enzymology has been rewarding in that products having practical usefulness for veterinary practitioners have been developed and are now available for use. Hydrolytic action of certain enzymes assist in drainage of infected wounds, abscesses, and fistulous tracts by liquifying tenacious, purulent materials. The valuable properties of the enzyme discussed by the author is its ability to reduce viscosity of pus, breakdown fibrin, facilitate granulation, and in general to clean up dirty wounds. It has been shown to be indicated as an aid in treatment of abscesses, chronic sinus tracts, and certain types of mastitis. Further field experience is expected to reveal even wider clinical usefulness.

WITHIN recent years much interest has been aroused in the use of proteolytic and fibrinolytic enzymes as aids in the treament of certain disease processes. Much of the early work was done by investigators in the field of human medicine[1,2,3] and has been carried over to be applied in the veterinary field. It has been shown by Sherry *et al.*[4] that desoxyribonucleoprotein is one of the principal constituents of all purulent exudates, and as such is important in determining the viscosity and amount of sediment in the exudates. Sherry *et al*[5] and Tillett *et al.*[6] also have shown that desoxyribonuclease is capable of breaking down desoxyribonucleoprotein, often resulting in a marked clinical improvement of the area treated. Desoxyribonuclease is an enzyme excreted by hemolytic streptococci during growth, but also can be derived from pancreatic tissue. Clinically its actions are: (1) To bring about a liquefaction of pus by breaking down desoxyribonucleoprotein when contact is maintained for a period of time; (2) to break down fibrin upon similar contact; (3) to facilitate the production of healthy granulation tissue; (4) in general, to clean up wounds, tracts and abscesses. There are two prerequisites to the accomplishment of this cleaning-up process: (1) Adequate direct contact must be maintained to allow fullest action to take place, to be followed by evacuation; (2) the material to be liquefied must be susceptible to this enzymatic action.

Material and Methods

This report is based upon clinical trials with the enzyme, pancreatic desoxyribonuclease (pancreatic dornase),** prepared from frozen beef pancreas. After extraction from the pancreas, the enzyme is sterilized through a bacterial filter, frozen and lyophilized. It is readily soluble in water. Its activity is measured and standardized by its ability to reduce the viscosity of thymonucleic acid. When the lyophilized pancreatic dornase is restored with the phosphate buffer diluent supplied, an optimum pH of 7.0 to 7.1 results.

Previous investigations revealed that pancreatic dornase is effective in the lysis of purulent exudates, as determined by changes in the viscosity of exudates. It should be mentioned that the primary action of this enzyme is upon desoxyribonucleoprotein and secondarily upon fibrin, although there is definite evidence of fibrinolytic activity. Milk from a clinical case of acute mastitis, containing thick slugs and strings, was collected in a test tube. Upon the addition of a small quantity of pancreatic dornase, a marked hydrolytic action took place within one-half hour.

Pancreatic dornase can be applied topically as wet packs, used to irrigate sinuses or fistulous tracts, injected into abscesses, body cavities, the pericardial sac and the mammary gland. It is important that adequate direct contact be maintained to assure uniform results. No accurate dosage schedule has been worked out, however, we routinely use 100,000 units or more, depending on the size of the area and the condition being treated. Treatments are repeated at intervals of one to three days or longer, depending on the clinical improvement noted.

In many instances some of the more commonly used antibiotics were incorporated with the pancreatic dornase in an attempt to en-

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**Grateful acknowledgement is made to Sharp & Dohme, Division of Merck & Co., Inc., Philadelphia, Pa., for the pancreatic dornase supplied for these clinical trials.

hance the process of cleaning up infected areas. *In vitro* studies reported by the producer of this enzyme indicate a minimal effect of the more common antibiotics upon the activity of pancreatic dornase.

It is recommended that once the dornase has been restored into solution with the diluent, it be used within a period of six to eight hours. It has been found that after this time, its activity gradually decreases.

Effect on Wound Healing

Investigations previously conducted by other workers revealed no significant gross delay in wound healing that could be attributed to the use of pancreatic dornase. Our clinical investigations substantiate this finding of little or no delay in wound healing.

Toxicity

At no time during these clinical trials was there evidence of any toxic effects that could be attributed to the use of pancreatic dornase. Topical applications daily over a period of a week or more apparently did not produce any undesirable effects on the patient. The result when the enzyme was injected into body cavities or sacs was the same. Toxicity trials were also conducted by injecting pancreatic dornase both intramuscularly and subcutaneously in one cow. No systemic or local reactions were evident. Two doses of 100,000 units of pancreatic dornase were given intramuscularly and subcutaneously on consecutive days. No soreness or local tissue reaction was evident beyond what one might normally expect to see when injecting any other nonirritating product. In addition, there is evidence that pancreatic dornase produces little or no irritation when infused into the mammary gland.

A Few Clinical Applications

Clinical investigations were carried on in the field of veterinary medicine in an attempt to evaluate the use of pancreatic dornase as an aid in the treatment of various disease conditions in which its pus-lysing action would be advantageous in hastening recovery of the patient. Its action was found to be efficacious in the treatment of many abscesses, fistulous tracts and chronically infected wounds with induration. Its ability to lyse pus and mucus was found to be advantageous in some cases of acute mastitis in which the secretion of the udder contained many plugs of pus and mucus. Two cases of traumatic pericarditis were treated without removal of the causative agent. The results were encouraging; the general condition of the patient was improved greatly following a more complete drainage of the pericardial sac than would have been possible without liquefaction of the pus and fibrinous exudates present.

Case 1. Chronic Mastitis

A case of chronic mastitis in a Guernsey cow, shedding thickened yellow strings of exudate, was presented for treatment. The mastitis, caused by *Pseudomonas aeruginosa*, had failed to respond to other methods of treatment. For three consecutive days 100,000 units of pancreatic dornase in 10 cc. of diluent were infused into each infected quarter and allowed to remain in the quarter for 24 hours before milking out. There was a marked change in the character of the secretion after the first infusion. The exudate was thin and was removed easily. Each successive treatment produced similar results, with the quantity of the exudate removed decreasing daily.

While there was no evidence of having relieved the udder of the causative organisms, the resulting change in the character of the exudate did facilitate clinical improvement.

Case 2. Acute Mastitis

A cow with acute mastitis involving both hind quarters was treated with 100,000 units of pancreatic dornase combined with 20 cc. of furacin®[1] infused into each quarter. Before treatment the secretion from the udder contained numerous clumps, slugs and strings of necrotic, purulent material. On the following day there was a noticeable change in the appearance and character of the udder secretion; it was now fluid in nature and contained relatively few slugs and strings. This made stripping of the quarters easier, and a larger quantity of secretion was obtained.

Case 3. Acute Mastitis

A fresh cow, who had calved normally and cleaned properly two days previously, developed an attack of acute mastitis of the right forequarter. The secretion was yellow and consisted almost entirely of thick, cheesy strings of exudate. Bacteriological cultures revealed a *beta* hemolytic micrococcus to be the invading organism.

Treatment was initated after stripping of the quarter and the collection of a sample of the secretion for cultural purposes. Pancreatic dornase (100,000 units) and crystalline penicillin (600,000) units were incorporated in 20

[1] Eaton Laboratories, Inc., Norwich, N. Y.

cc. of penicle®[3]. This was infused into the affected quarter. On the following day, little evidence of clinical improvement was noted, and clots of blood were present in addition to the stringy exudate. Treatment at this time, after stripping, consisted of pancreatic dornase 100,000 units and crystalline penicillin 600,000 units dissolved in 20 cc. of sterile water. On the third day, clinical improvement was noted. The secretion from this quarter was now fluid in nature and contained only a few slugs, which could be easily expressed. In addition, the swelling and hardness of the quarter was noticeably reduced. Treatment on this day consisted of pancreatic dornase (100,000 units) incorporated in 15 cc. of penicle infused directly into the quarter. No flakes or slugs were evident on the fourth day, and return of the quarter to production followed rapidly.

It is felt that pancreatic dornase was of considerable value in the treatment of this case of acute mastitis. Its application with sterile, distilled water as the vehicle appeared to be more effective. The use of one of the oxytocic hormones for its "let-down" effect on the udder might have enhanced recovery, had it been used.

Case 4. Acute Septic Mastitis

A valuable purebred Guernsey cow suffering from acute septic mastitis was presented for treatment. The owner had applied both systemic and local antibiotic treatment for 10 days before calling for assistance. All four quarters were affected, however, the most severe disturbance was evident in the forequarters. The left forequarter was hard, hot and painful. The secretion consisted of a serous fluid which contained many clots of blood and clumps of caseous exudate. Secretions obtained from the right forequarter contained thick, yellow slugs. Samples collected aseptically for bacteriological examination were negative; this finding was not surprising following all the previous antibiotic medication applied by the owner.

Treatment consisted of systemic therapy in addition to udder infusion. Pancreatic dornase 100,000 units, combined with crystalline penicillin and dihydrostreptomycin, were infused into each quarter. Six hours later, samples of secretion drawn from all four quarters did not reveal any evidence of strings or slugs. Except for a few small flakes, the secretion was of a thin, fluid consistency. All evidence of blood clots had disappeared.

On the second day, no flakes were evident in the rear quarters. The left forequarter was unchanged, except now only relatively few slugs were found, the remainder of the secretion being abnormal in appearance but of normal consistency. The same treatment was applied to both forequarters, and systemic therapy was continued.

On the third day, no flakes or slugs were evident in the secretion from any of the four quarters. From this point on, the general condition of the cow slowly improved. The left forequarter, however, continued to shed a few flakes or slugs. The appearance of this abnormal secretion was intermittent; however, little hope was held that this quarter would ever return to production, due to the severe tissue damage, with its resultant fibrosis.

The infusion into the udder for three consecutive days of 100,000 units of pancreatic dornase combined with antibiotics resulted in marked clinical improvement.

Case 5. Bone Sequestra

A pony with a wound over the tuber ischii was presented for treatment. Examination revealed two openings discharging a thick, yellow, purulent exudate. A fracture of a portion of the tuber ischii, with resulting bone sequestra and necrosis, was diagnosed.

Surgical removal of the bone fragments and curettement with appropriate aftercare did not result in normal healing. In time, progress in the extent of healing had become static. It was at this time that the proteolytic enzyme became available. For six consecutive days, 100,000 units of pancreatic dornase were placed into the discharging sinus. Contact with walls of the tract was maintained by wetting sterile gauze with the restored solution of dornase and packing this gauze into the sinus. By the sixth day, considerable improvement was evident, The sinus had decreased in size and was granulating. All the discharge was fluid in nature and appeared to come from the superficial portions of the sinus.

From this point on, healing was slow but progressive. The use of pancreatic dornase seemed to be the turning-point in the treatment of this protracted case of a chronic fistulous sinus.

Case 6. Fistulous Tract

A horse having suffered a traumatic rupture of the superficial flexor tendon of the right hind leg was treated for a chronic draining fistulous tract. Suturing of the tendon had failed, because of the duration of the condi-

[3]Wallace Laboratory, Inc., New York, N. Y.

tion when first observed. The wound was infected and healing was allowed to take place as an open wound. Suitable support for the leg was arranged and the usual principles of wound therapy applied. As granulation tissue filled in the area, it became apparent that a chronic draining sinus was present, extending upward into the tendon sheath. For eight consecutive days, 100,000 units of pancreatic dornase dissolved in 5 cc. of diluent were used to wet a small piece of sterile gauze. Penicillin 200,000 units and dihydrostreptomycin 250 mg. were added to the enzyme solution. The sinus then was packed. After the eight-day treatment period, the sinus had decreased in size to such an extent that it was no longer possible to maintain a pack in position. Healing continued from this point, with recovery uneventful.

Case 7. Umbilical Abscess

A Guernsey heifer, seven months of age, was presented for repair of an umbilical hernia. Examination revealed not a hernia, but a large abscess. After proper preparation, the area was incised. A large quantity of yellow, cheesy, granular pus escaped. Examination disclosed an opening 2 in. in diameter through the umbilicus and small cavity present within the abdomen. After irrigation, the cavity within the abdomen was packed with two sterile gauze sponges which had been made wet with 200,000 units of pancreatic dornase combined with antibiotics (penicillin and dihydrostreptomycin). The larger cavity, outside the abdominal wall, was swabbed with Lugol's solution. Within three days the internal cavity was reduced in size by one-third, and within two weeks practically the entire area was healed. Pancreatic dornase applied for only four days appeared to exert a debriding action on the walls of the cavity. Rapid granulation of the area followed. Recovery was rapid and uneventful.

Case 8. Abscess of the Hock Joint

History indicated that this aged, purebred Guernsey cow had developed an abscess of the hock while in the stable. She was now in a box stall and a large swelling could be seen on the lateral surface of the right hock. Palpation revealed it to be firm, with little fluctuation. Knowing that most abscesses in this area contain cheesy, necrotic tissue and drain improperly when opened, it was decided to inject pancreatic dornase into the lesion. The aim was to bring about liquefaction of the material contained.

Pancreatic dornase (100,000 units), dissolved in 5 cc. of diluent, was injected into the center of the lesion. No attempt to establish drainage was carried out at this time. On the second day no change was evident, and the same treatment was repeated. No further treatment was given until the fifth day. At this time, fluctuation was apparent upon palpation of the lesion. After proper preparation, the abscess was lanced, and a considerable quantity of a well-liquefied exudate escaped. The area was irrigated with soluthricin®* solution. Rapid healing followed within three days.

Case 9. Infected Castration Wound

An Angus-Guernsey bull calf had been castrated by the open method two weeks previously. When first seen, the left side of the scrotum was hard, hot, painful and indurated. Induration extended upward into the inguinal canal on this side and a fetid brown discharge was present. A diagnosis of an infected castration wound was made.

After irrigation with sterile physiological saline solution, the area was packed. Sterile gauze sponges soaked in a solution containing pancreatic dornase (100,000 units), crystalline penicillin (500,000 units), and dihydrostreptomycin (750 mg.) were placed in the wound. The animal was revisited on the third day, at which time no change was evident. The above treatment was repeated, and on the sixth day some improvement was noted. The area of induration was reduced and the odor of the discharge had improved. By the 13th day it was apparent that the drainage opening was too small. After the opening had been enlarged, the cavity was repacked with 100,000 units of pancreatic dornase combined with 20 cc. of soluthricin.

From this point, recovery was rapid and no further medication was required.

Case 10. Traumatic Pericarditis

Surgical resection of the sixth rib was performed for relief in a case of traumatic pericarditis in a cow. Due to the extensive changes found, it was impossible to open the pericardial sac to drain it in the usual manner. Approximately 2,400 cc. of purulent exudate were withdrawn from the pericardial sac by means of a syringe. Postoperative treatment consisted of a blood transfusion and systemic antibiotic therapy. On the fifth postoperative day, the temperature began to rise, and an additional 500 cc. of pus were withdrawn. Aqueous

®*Sharp & Dohme, Division of Merck & Co., Philadelphia, Pa.

crystalline penicillin and dihydrostreptomycin were then injected into the pericardial sac. The temperature dropped and the patient became alert once more and began to eat. Subsequent attempts to aspirate material from the pericardial sac were discouraging, as flocculent debris would plug the needle and the exudate was becoming thicker.

On the 16th postoperative day, 100,000 units of pancreatic dornase combined with 1,000,000 units of crystalline penicillin and 1 gm. of dihydrostreptomycin were injected into the pericardial sac after aspirating 200 cc. of pus. Another tap made on the 20th postoperative day resulted in the withdrawal of 600 cc. of pus which was now well-liquefied. Withdrawal was accomplished with little difficulty. The same combination of pancreatic dornase and antibiotics was injected into the sac. On the 27th day (11 days after the first injection of pancreatic dornase), 1,800 cc. of exudate could be aspirated. The same combination of antibiotics and pancreatic dornase was injected at this time, and on the 33rd day only 90 cc. could be withdrawn. By this time the patient showed marked improvement. She had aborted ten days previously, but it was not felt that the treatment or medicinal agents played any part in this development. The heart was now clearly audible, the pulse rate nearly normal, and the jugular veins less distended.

Soon afterward, the patient was discharged, apparently in fairly normal condition. Realizing that we had not been able to remove the causative agent, we gave a guarded prognosis. Four months later the cow suddenly sickened and died. Death was due to the foreign body having penetrated the ventricle of the heart, with resulting hemorrhage.

Case 11. Traumatic Pericarditis

A cow, showing typical signs of traumatic pericarditis, was treated with two doses of 100,000 units each of pancreatic dornase injected directly into the pericardial sac. An attempt to withdraw exudate by a pericaridial tap was successful on the first day, approximately 500 cc. being removed. On the third day, additional exudate was withdrawn and a second dose of pancreatic dornase injected. There was a marked clinical improvement at this time; however, a favorable prognosis could not be given, since the causative agent had not been removed. The owner was therefore advised to send the cow to slaughter.

It is felt that the use of pancreatic dornase resulted in improvement of this animal to the extent that her market value was considerably increased.

Case 12. Actinomycosis

A Guernsey cow with actinomycosis was presented for *x*-ray treatment. The usual series was given. Within six weeks there was no evidence of recession of the swelling. Upon examination, the enlargement was found to be sensitive. Needle puncture revealed that there was an accumulation of pus in two sites. These areas were punctured with a 16-gauge needle and the pus aspirated. All could not be removed, so 100,000 units of pancreatic dornase were injected into the abscessed cavity. Twenty-four hours later there was no appreciable change in the consistency of the pus. Only small amounts could be obtained on subsequent attempts at aspiration.

This one trial cannot be regarded as having any particular significance, due to the circumstances involved. It is felt that more investigations into this type of case should be made.

Discussion

Results obtained with pancreatic dornase in the treatment of the above cases are encouraging. It is hoped that this report will stimulate others not only to improve methods of application of this enzyme but also to find new uses for the product.

Cases 1 and 8 show the effectiveness of pancreatic dornase alone in liquefying purulent exudates and necrotic tissue.

The response shown in the cases of traumatic pericarditis treated indicate that further investigations should be made in treating this disease condition.

Further studies using pancreatic dornase in cases of actinomycosis also should be undertaken.

Cases 5 and 6 are typcial of cases of chronic draining sinuses which are often difficult to treat. Pancreatic dornase in these cases produced very encouraging results in a relatively short time.

Cases 1, 2, 3 and 4 illustrate adequately the value of this enzyme in the handling of acute cases of mastitis. The liquefaction of the secretion of the udder in these cases greatly facilitated the action of the antibiotic therapy by allowing more complete emptying of the affected quarters. The additional use of hormones stimulating let-down action of the milk glands should be advantageous.

If used properly in disease conditions where its action would be desirable, pancreatic dornase should become a valuable adjunct to veterinarian's armamentarium.

Summary

A small group of case reports is presented to point out a few of the conditions in which the use of pancreatic dornase is helpful. Pancreatic dornase, an enzyme derived from frozen beef pancreas, is capable of degrading desoxyribonucleoprotein, one of the prinicipal constituents of all purulent exudates. Clinically, it brings about a liquefaction of pus, breaks down fibrin and facilitates the cleaning up of a wound, with the resultant production of healthy granulation tissue. It has been shown to be indicated as an aid in the treatment of abscesses, chronic sinus tracts, and certain types of mastitis. In addition, further trials should be conducted in the treatment of traumatic pericarditis and actinomycosis.

Sincere appreciation is acknowledged to Dr. Maurice Arnold and Dr. Walter LaGrange for their assistance in this investigation.

REFERENCES

1. Adie, G. C., and Childress, W. G., Experiences with Streptokinase and Streptodornase. *Ann. Surg.*, 134:659 (Oct.), 1951.

2. Wright, L. T., Smith, D., Rothman, M., Metzger, W. I., and Quash, E. T. Use of Streptokinase-Streptodornase in Certain Surgical Conditions. *Jour. Internat. Coll. Surgeons*, 15:286 (Mar.), 1951.

3. Tillett, W. S,, Studies on the Enzymatic Lysis of Fibrin and Inflammtory Exudate by Products of Hemolytic Streptococci. Harvey Lecture Series 1949-50, C. C. Thomas, Springfield, Ill., publishers, 1951.

4. Sherry, S., Johnson, A., and Tillett, W. S., The Action of Streptococcal Desoxyribonuclease (Streptodornase) on Purulent Exudates. *Proc. N. Y. Path. Soc.* 96, 1948-49.

5. Sherry, S., Johnson, A., and Tillett, W. S., The Action of Streptococcal Desoxyribose Nuclease (Streptodornase) *in vitro* and on Purulent Pleural Exudations of Patients. *Jour. Clin. Invest.*, 28:1094, 1949.

6. Tillett, W. S., and Sherry, S., The Effect in Patients of Streptococcal Fibrinolysin (Streptokinase) and Streptococcal Desoxyribonuclease on Fibrinous, Purulent and Sanguinous Pleural Exudations. *Jour. Clin. Invest.*, 28:173, 1949.

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Mr. Harry Miller, director of the Gaines Dog Research Center, New York, calculates that there is one practing veterinarian in the United States for every 1,700 dogs.

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Farmer's Bulletin No. 834 designates a revision of an older bulletin on hog cholera prepared by the United States Department of Agriculture.

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Cash income from milk leads all other products as a source of cash income for farmers.

Foreign Animal Diseases

(Continued from page 232)

6. Ramsey, F. K., Chivers, W. H., Mucosal Disease of Cattle, *N. Am. Vet.*, 34:629 (Sept.), 1953.

7. Pilet, E., Verge, J., Enzootic Meningo-Encephalomyelitis of Swine (Teschen Disease). Office International Institute of Epizootic Bulletin, 35 (July-Aug.), 1951.

8. Dunn, H. W., Smith, E. M., Rummels, R. A., Stafseth, H. J., Thorp, F. Jr., A Study of Encephalitic Strain of Hog Cholera Virus. Journal article 1318 of Michigan Agricultural Experiment Station, East Lansing.

9. Montgomery, R. E., A Form of Swine Fever Occurring in British East Africa. *Jour. Comp. Path. and Ther.*, 34 (Sept. 30, 1931), 1921.

10. Steyn, D. G., East Africa Virus Disease in Pigs. 18th report of Director of Veterinary Service and Animal Industry, Union of South Africa, August 1932.

11. DeKock, G. W., Swine Fever in South Africa. *Onderstepoort Jour. Vet. Sci. and An. Ind.*, 14:31 (Jan. and Apr.), 1940.

12. Alexander, R. A., Rift Valley Fever in the Union. *Jour. Am. Vet. Med. Assn.*, 22:105, 1951.

13. Rivers, Viral and Rickettsial Infections of Man. Ed. 2, Philadelphia, Lippincott.

14. Daubney, R., Hudson, J. R., Anderson, J., Sterility. *E. African Agr. Jour.*, :31 (July), 1938.

15. Report of Committee on Exotic Diseases. Proceedings of the 56th annual meeting USLSA, Atlantic City, New Jersey, Sept. 23-25, 1953.

16. Henning, M. W., Animal Diseases in South Africa. Ed. 2, Johannesburg, Central News Agency, Ltd., 1949.

17. Hagan, W. A., Bruner, D. W., The Infectious Diseases of Domestic Animals. Ed. 2, Ithaca, Cornell University Press, 1951.

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In an article entitled, Analysis of the Value of Chemotherapeutic Agents in the Treatment of Tuberculosis, by Corper, in the April 25, 1953 issue of the *Journal of the American Medical Association*, we note in part of the summary that the tubercle bacillus is capable of surviving under the following conditions: "(a) Over 30 years at incubator (37 C.) temperature; (b) over five years dehydrated and sealed in glass; and (c) in the body for decades, at least in a virulent or low virulent state in the absence of evident growth." In the summary there is also the following: "Growth and destruction laboratory tests on the bacilli must be evaluated guardedly . . . since the bacilli are capable of adapting themselves to most antibiotics and chemotherapeutic agents within a relatively short time *in vitro* and *in vivo*." Furthermore, "At present . . . two chemotherapeutic agents — the antibiotic streptomycin (and its closely related compounds) and isoniazid (and its homologues)— possess merit as static adjuvants to the scientific medical treatment of tuberculosis for limited periods of time only, and under the best medical supervision, because the bacilli develop a resistance to their retardant action."

Leptospirosis In The Dog*

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Leptospirosis appears to have world-wide distribution and though existing for many year has only recently been revealed as a specific infectious disease caused by one of several species of Leptospira. All the facts regarding spread, contagious, etc., as well as those concerning host susceptibility and contagiousness between various animals and man still needs to be learned. Veterinary authorities now consider leptospirosis a major disease, often misdiagnosed, and responsible for morbidity and deaths in pet and domestic animals. Medical authorities have also presented evidence suggesting that the disease is a hazard to public health.

"Leptospiroses are found whenever and wherever they are sought"—Martha K. Ward.

FOR at least 50 years veterinarians attending small animals have observed a syndrome in dogs associated with the disease now called leptospirosis. Prior to a decade ago the disease was identified by a number of names, among which were, Stuttgart disease, canine typhus, Weil's disease, infectious icterus, and the "yellows." According to Randall[1] this disease, known as leptospirosis, was first reported in Europe in 1916 and in the United States in 1923. At least 16 strains of Leptospira were reported from various parts of the world, and at least three species were isolated from the dog. These were *Leptospira icterohemorragiae, L. canicola, and L. pomona.* Meyer and his coworkers[2] were first to recover *L. canicola* in this country during an enzootic of the disease in California in 1937. Randall and Cooper[3], in 1943, recovered *L. icterohemorrhagiae* from dogs with the disease in Washington, D. C.

Occurrence

The disease appears to have world-wide distribution. Surveys,[3,4] most of which were based on serological findings, indicated that the incidence in the San Francisco, Calif. area was 34%, Santa Rosa, California, 14%, New York City 12%, rural Alabama 3.6% and Pennsylvania 38%.

Randall, citing Raven, stated that, from data compiled by the latter, 11 to 38% of the dogs in different localities in the United States were temporary or permanent carriers and shedders of Leptospira. *L. canicola* was by far the most prevelant in this country. Surveys made in Europe[5] indicated that the incidence of leptospirosis was greater on that continent than in the United States. Also, the ratio of *L. icterohemorrhagiae* to *L. canicola* was higher in Europe.

Etiology and Epidemiology

The etiological factor in canine leptospirosis in the United States is, primarily, *L. canicola.* Occasional infection with *L. icterohemorrhagiae* is seen. It is believed that *L. pomona* plays a very small etiological role in the dog[6]. The disease is observed in both sporadic and enzootic proportions. Frequently, the spread is rapid in a dense population of dogs. In areas where the winters are mild, the disease occurs the year around; in areas where the winters are severe, there is decreased incidence during cold weather. It is believed that the dog is the natural host for *L. canicola,* and that the disease is passed from one host to the next by contact. The organisms are passed in the urine of a

*Approved for publication as Miscellaneous Journal Series Paper No. 831, Minnesota Agricultural Experiment Station.

convalescing or recently non-treated recovered patient. A higher incidence of the disease is found in male dogs and in animals over three years of age. These last stated facts may be explained easily when the habits of male dogs, in greeting each other, are considered. The brown rat is believed to be the natural host for *L. icterohemorrhagiae*. The incidence of *L. icterohemorrhagiae* infection in rats in the United States is believed to be between 10% and 40%. Once a rat is infected, it is believed that the recovered animal sheds the organism in the urine for the rest of its life. *L. icterohemorrhagiae* infection is transmitted to dogs from rats through the medium of rat-urine-contaminated food or water. Also, it is believed that it is possible for dogs to become infected by the drinking of, or wading in, contaminated water in stagnant pools. It has been shown that *L. icterohemorrhagiae* can live for a period of 22 days in stagnant water if the reaction is neutral or slightly alkaline[7].

Pathogenesis and Pathology

As yet, the pathogenesis of leptospirosis is not understood. We can only surmise what takes place from our knowledge of the epidemiology, the clinical findings, and the postmortem picture of the disease. From the evidence available, we might theorize that the organism enters the animal's body through the alimentary tract, or possibly the respiratory portal. After an incubation period of six to 14 days, during which time the organism probably is localized and multiplying in the tissues at the site of entry, the organism enters the blood stream and continues to multiply and produces bacteremia. The early clinical findings of malaise, inappetence, hyperthermia, and petechiation of the visible muscous membranes accompany this stage. As far as is known Leptospira are not exotoxin or endotoxin producers. Yet, some factor, probably end products of their metabolism, appear to do considerable damage to the endothelium of the blood vessels in acute disease. Monlux[8] gives a good description of the pathological changes in acute leptospirosis. He describes petechial hemorrhages throughout the animal body on the serous and mucosal surfaces in the brain, in heart muscle, and in the subcutaneous tissues. He shows pictures of a hemorrhagic lung. During the acute stage of the disease the renal cortices become infiltrated with mononuclear cells and show some evidence of tubular degeneration. It would appear that the tissues that have the best blood supply suffer most during the acute stage of the disease, suggesting the possibility of a circulating toxolytic product associated with the presence of the organism.

According to MacIntyre,[9] the gross renal pathological changes as seen in acute leptospirosis are rather characteristic. The kidneys are swollen, pale, and not adherent to their capsules. Frequently, there is a broad band of yellowish or yellowish-white tissue at the border of the cortex and medulla. Upon microscopic examination the intensity and extent of the cellular infiltration are striking. The band of yellowish-white tissue mentioned above is due to the mononuclear cell infiltration. The infiltration is primarily interstitial and peritubular. Only on rare instances is the cellular infiltration seen within the tubules. The tubular epithelium shows some cloudy swelling and hyaline degeneration. At times leptospira organisms are demonstrable within the tubules late in the acute stage. The medullary portions of the organ are relatively free of infiltration. If the nephritis is sufficiently severe, the animal will die of acute uremia and possible associated toxemia[7,9].

After four to seven days following the onset of the disease the organisms virtually leave the blood stream and, as far as is known, enter the kidney where they are demonstrable for sometime. MacIntyre[9] states that the route is hematogenous, and believes that the organisms enter the interstitial tissue from the blood vessels, hence to the tubules where they are rather commonly found in silver-stained tissue sections. It would appear that the organisms are capable of living and multiplying for some time in the renal tubules. During their presence, they stimulate a low-grade inflammatory reaction in the interstitial tissues which results in a comparatively slow, progressive, chronic nephritis.

A small percentage of the animals affected will develop icterus due to the inability of the liver to perform its normal salvage work in the conservation of hemoglobin. This product is plentiful because of the vast amount of hemorrhage present. The liver is damaged during the acute stage of the disease, and a variable degree of additional damage results from the presence of renal retention products that accumulate in the blood as a result of faulty kidney function.

The postmortem changes seen in chronic leptospirosis are somewhat different than those of the acute. MacIntyre[9] states that the outstanding lesion, other than renal, is a con-

centric muscular hypertrophy of the left ventricle of the heart. Animals that succumb show many of the same lesions seen associated with the acute syndrome, plus necrotic stomatitis.

In the chronic stage of leptospirosis the kidneys are contracted, pale, and have a finely granular surface. Microscopically, fibrosis of the interstitial tissue is the most striking change. A small amount of mononuclear infiltration is present. Rarely, Leptospira are observed. The capsules of the renal corpuscles are thickened. The walls of the arterioles show evidence of degeneration. As a result of fibrosis, atrophy of many tubules occurs and a resulting compensatory cystic hypertrophy of remaining tubules is seen. As a result, there are a comparatively few large cystic tubules surrounded by a matrix of connective tissue.

Clinical Signs and Course

Leptospirosis, caused by either *L. canicola* or *L. icterohemorrhagiae*, may be observed in several forms. The peracute form may terminate fatally in as short a time as 18 hours; the acute form is commonly seen whose course may extend for two to four weeks; and the chronic form which may last for as long as six months. It should be emphasized that mild cases occur, some of which are subclinical in character. The typical course of leptospirosis is charaterized by two indistinct stages, the septicemic or invasive phase, and the toxic phase. Duration of the former is about one week while the latter may last from one to several weeks. The onset is rather sudden. The animal is febrile, dull, inappetent and walks about with a cautious gait. There is frequent muscular tremor, stiffness in the hind legs and a "tucked-up" appearance of the abdomen. The oral and conjunctival membranes are muddy-red in color. Frequently there are small petechiae on the buccal mucosae, pharynx, and epiglottis[11]. In this stage there is occasional emesis. Usually, no feces, or small amounts are passed. If an enema is given, yellowish-orange-colored feces that are putty-like in consistency, followed by bile-stained fluid are obtained. Witter[11] believes this finding is of considerable diagnostic importance when seen with the attending signs of leptospirosis. Deep palpation of the renal region induces pain. The degree of pain must be differentiated from the dislike that a normal dog has for deep palpation of this area. Occasionally, a trace of exudate is seen in the nostrils, and frequently a cough can be stimulated by palpation of the trachea.

Five to seven days following the onset of disease, the affected animal enters the so-called "toxic stage." This stage is characterized clinically by the uremia syndrome. The temperature falls to normal or slightly subnormal. Many of the symptoms seen during the septicemic stage are present but are more pronounced. The animal is totally inappetent, the conjunctival and buccal mucosae are more congested, and frequently the areas of petechiation seen on the buccal mucosa in the early stage of the disease have undergone degeneration, and ulcers are present. These are frequently seen on the inner aspect of the lips opposite the roots of the canine and upper fourth premolar teeth. The gingivae bleed easily. At times there is a brown coating on the teeth and frequently the margins of the free part of the tongue are necrotic. On occasion bile-stained vomitus is ejected from the stomach, and blood-tinged, fluid bowel movements are seen. Dehydration is rapid and extreme, and emaciation results. The breath has a characteristic "uremia" odor. Animals in this stage of the disease undergo nitrogen retention with a resultant increased elimination of urea in the saliva and secretions from the mouth. The urea is split into ammonia and carbon dioxide by bacterial enzymes in the mouth, which results in an ammoniacal odor. According to Witter,[11] 3 to 50% of the affected animals show a degree of icterus. In some individuals profound icterus is seen.

It is possible, by dark field technic, to demonstrate the organism in the serum of some of the patients during the septicemic stage, and in the urine during the toxic stage. Negative results, however, have little meaning. It should be pointed out that the organisms are quickly destroyed in acid urine. If a dark field examination is to be performed on the urine of a dog, sodium bicarbonate should be administered to the patient a few hours prior to obtaining a sample of the urine for examination.

Bild[13] places considerable emphasis on an elevated blood urea nitrogen (BUN) in the diagnosis of leptospirosis. In leptospirosis the nitrogen retention is elevated during the early stage of the disease, then recedes slightly, after which it again rises as the toxic stage of the condition becomes evident[11]. A BUN of 70 mg.%, when associated with the clinical picture of leptospirosis, adds support to its diagnosis.

A leucocytosis, which is primarily a neutrophilia, is seen three to four days after the onset of illness. This finding is helpful in arriving at a diagnosis and should receive considerable emphasis when associated with the clinical findings.

The sedimentation rate is increased and, according to Monlux,[12] is a consistent finding.

Antibody titer is present eight to nine days after the onset of the infection, reaches its peak in the third week, and declines after six to seven weeks[11]. Agglutination, lysin-agglutination, and complement fixation tests are performed in some laboratories on the serum of leptospirosis suspects.

Cultural technics are unreliable in the detection of leptospirosis. Growth is slow and difficult even on special media. Reinhard[14] suggests the use of Chang's medium, Vervoort's medium, and embryonated eggs cultural technics.

Animal inoculation is used to isolate and separate the Leptospira organism from contaminated material. Young hamsters are most susceptible and useful for this purpose. Young guinea pigs are somewhat less susceptible. At times it is necessary to make one or two blind passages through laboratory animals to increase the virulence of the organism to the degree where lesions and clinical symptoms are produced.

Diagnosis

Unfortunately it is necessary for the practitioner to rely primarily on the results of physical examination and a few of the laboratory aids (hematology, sedimentation rate, and BUN) for a diagnosis. As yet, methods of laboratory confirmation of the diagnosis, early in the course of the disease, are lacking. The finding of the causative organism in the serum or urine is an obvious exception to this last statement, but this, unfortunately, is not commonly achieved.

A history of possible exposure, typical onset, signs seen early in the septicemic stage, elevated sedimentation rate, and BUN, together with the findings upon physical examination and an associated leucocytosis, should allow one to make presumptive diagnosis of acute leptospirosis. The condition must be differentiated from distemper, infectious hepatitis, nonspecific nephritis, gastrointestinal obstruction, and rheumatism. In general, distemper and hepatitis are seen in younger age groups of animals. In the former the respiratory symptoms are much in evidence; in the latter, marked swelling of lymph nodes and weakness are present. In both there is a leucopenia. The differentiation of leptospirosis and nonspecific nephritis depends upon demonstrating the organism present; this may be difficult to do. Gastrointestinal obstruction can be differentiated on the basis of history, signs, and radiological findings. Rheumatism is usually not accompanied by the malaise and generalized effects seen associated with leptospirosis.

Prognosis

The prognosis in clinical leptospirosis is guarded. Susceptible animals may exhibit a fulminating infection in as short a time as 18 hours. Less acute cases can terminate from a rapidly developing renal failure, and chronic cases can terminate from similar causes with an attending gradually-developing uremia. Any animal displaying icterus must be given a poor prognosis. MacIntyre states that any animal that has a BUN of 70 mg.% is a poor risk indeed. It would seem, then, that the prognosis should be based on the intensity of the uremic syndrome present, the level of the BUN, and the presence, or absence, of icterus.

Treatment

Witter[11] suggests the use of penicillin G in saline every six hours for two days in a dosage of 600,000 units per day. After the initial two-day period, 200,000 units of aqueous, procaine penicillin are given per day and continued for at least five days, even though the animal appears to be making a recovery prior to that time. If this is not done a relapse occasionally occurs. In addition, 5 to 10 gr. of methenamine are given two times a day and continued for three weeks. In addition to penicillin and methenamine, Witter suggests supportive treatment consisting of fluids, crude liver injections, thiamine hydrochloride, and adequate nutrition. He suggests daily enemas of 5% sodium bicarbonate solution. This practice decreases intestinal ulceration. He suggests antiserum and sulfonamides for the control of respiratory complications, and bile salts to aid liver function.

Brunner[15] suggests the use of 40 mg. of streptomycin per kg. body weight daily for the treatment of leptospirosis. He believes this therapy will prevent the shedding of the organisms in the urine by the recovered patient. He stated that penicillin will not overcome this objection. Witter believes that the use of methenamine, in combination with penicillin, makes the use of streptomycin unnecessary.

Heilman[16] reported on the use of aureomycin in the treatment of experimentally-induced Weil's disease in guinea pigs and hamsters. His work would indicate that aureomycin is effective in combating *L. icterohemorrhagiae*.

Prophylaxis

At the present time vaccination against leptospirosis is not routinely practiced in this country. Some European countries do employ vaccination; however, leptospirosis antiserum has been offered to the profession from time to time by American biological producers, but it would appear that the use of serum in this country has not been extensive. Products for the production of both an active and passive immunity[17] can be produced, and no doubt will be made available if there is a demand for their use.

Control

While the detection and proper treatment of active cases will help to eliminate the number of chronic shedders of the organisms, we still must consider the large number of subclinical cases that constitute a possible reservoir of infection. These cases, in part, can be detected only by serological means. Without extensive public education relative to leptospirosis and excellent public cooperation, such a testing program would not appear feasible. Until better methods of diagnosis are discovered and general prophylaxis is practiced, it would appear that our best recourses relative to control are confinement of dogs, the elimination of stray dogs, and adequate control of rats.

Public Health Relationship

Weil's disease, caused by *L. icterohemorrhagiae*, has long been recognized as a disease entity in man. Randall[1] stated in 1948 that there were no more than 30 cases of *L. canicola* infection recorded in man. Stoenner[18] believes that there are far more cases of human leptospirosis of both types than are diagnosed. He indicates that canicola fever is a rather common entity in Europe and probably is frequently misdiagnosed in this country. Leptospirosis, whether it be caused by *L. icterohemorrhagiae* or *L. canicola*, is a definite human health hazard.

Summary

1. Leptospirosis is not a comparatively new disease.

2. Leptospirosis has a world-wide distribution and a probable incidence of 11% to 38% in the United States.

3 The pathological changes, possible pathogenesis, clinical aspects, and treatment of leptospirosis in dogs are discussed.

4. Leptospirosis is difficult to control.

5. Leptospirosis caused either by *L. icterohemorrhagiae* or *L. canicola* is a definite human health hazard.

REREFENCES

1. Randall, Raymond, Canine Leptospirosis. *Jour. Am. Vet. Med. Assn.*, 112:136-139, 1948.

2. Meyer, K. F., Stewart-Anderson, M. A., and Eddie, B., Canine Leptospirosis in the United States. *Jour. Am. Vet. Med. Assn.*, 95:710, 1939.

3. Randall, R., and Cooper, H. K., The Golden Hamster as a Test Animal for the Diagnosis of Leptospriosis. *Science*, 100:133, 1944.

4. Jones, T. C., Roby, T. O., Davis, C. L., and Maurer, F. O., Control of Leptospirosis in War Dogs. *Jour. Am. Vet. Med. Assn.*, 106:120, 1945.

5. Klarenbach *et al.*, (cited by Meyer) (*Nederal. tijdschr. v. geneesk*, 3:4097, 1930.

6. Reinhard, Karl R., Newer Knowledge of Leptospirosis in the United States. *Ext. Parasitology*, 2:87, 1953.

7. Joshua, J. O., Clinical Aspects of Leptospirosis, *Vet. Rec.*, 61:714, 1949.

8. Monlux, W. S., Leptospirosis, *Cornell Vet.*, 38:199, 1948.

9. MacIntyre, W. I. M., and Montgomery, S. L., Renal Lesions in *Leptospira canicola* Infection in Dogs. *Jour. Path. and Bact.*, 64:145, 1952.

10. Stunzi, H., Pathological Physiology to the Kidney. (Not published).

11. Witter, R. E., Clinical Diagnosis and Treatment of Leptospirosis. *Proc. Am. An. Hosp. Assn.*, 1953, p. 228.

12. Bild, C. E., The Use of the Determination of the Urea Content of the Blood in the Diagnosis of Leptospirosis in the Dog. (To be published).

13. Monlux, W. S., Leptospirosis. *Cornell Vet.*, 38:109, 1948.

14. Reinhard, Karl R., Leptospirological Techniques. Leaflet, Rocky Mountain Laboratory, Hamilton, Mont.

15. Brunner, K. I., and Meyer, K. F., *Proc. Soc. Exp. Biol. Med.*, 70:450, 1949.

16. Heilman, Fordyce R., Aureomycin in the Treatment of Experimental Relapsing Fever and Leptospirosis Icterohaemorrhagica (Weil's Disease). *Proc. Staff Meetings of the Mayo Clinic*, 23:569, 1948.

17. Brunner, T. K., Canine Leptospirosis. *N. Am. Vet.*, 80:517, 1949.

18. Stoenner, H. G., Personal communication.

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Filmstrip on Transparent Dog

A filmstrip based on the famous educational "Vesta—the transparent dog" exhibit of the Gaines Dog Research Center has been prepared as a public relations tool for veterinarians by the Institute of Visual Training, 40 E. 49th Street, New York 17, N. Y.

The filmstrip is designed especially to give practitioners an opportunity to talk about their profession before civic organizations, school groups, women's clubs, church societies and other local organizations.

The filmstrip, which consists of 36 black-and-white frames, is accompanied by a suggested mimeographed talk keyed to each frame. The complete package, in a special container, is available for $2.50.

Cesarean Section In The South American Chinchilla†

P. M. NEWBERNE*, D.V.M., M.S., and F. A. HAYES**, A.B., B.S., D.V.M.

IN view of the high value placed upon the individual animal, "culling" of female chinchillas experiencing difficulties in parturition is an extremely costly practice. Consequently, the propagation of this type animal continues, and the necessity for surgical intervention at the time of labor is increasing. The chinchilla industry also is experiencing a tremendous expansion, with an ever-increasing number of practitioners being confronted with the animal as a patient.

Of the limited number of major surgical procedures developed for this animal, cesarean section is no doubt preeminent. It is by no means new, the operation having been successfully performed by a number of veterinarians. It is routine practice at Evergreen Ranch. Nearly every practitioner has the knowledge and training necessary for the consummation of the operation, and it is the objective of this paper to encourage more men in the field to participate in this phase of veterinary practice. It is as much a part of the profession as canine and feline surgery, and in many respects, equally as attractive.

Indications. As in the case of other mammals, indications for cesarean sections are many[1,2,3]. The same conditions producing dystocia in other animals also are applicable to the chinchilla. It is generally considered that where accouchment has not been accomplished in the animal under consideration within a four-hour period following the onset of labor, surgery is an exigency. Beyond this point, further delay usually increases the hazard of the operation.

Anatomy. Prior to a presentation of the surgical technic, a brief description of the female organs of reproduction seems justified. A similarity exists between the uterus of the chinchilla and that of the dog or cat. For all practical purposes, the location and extracting of the fetus is accomplished identically as would be the case with these animals. The accompanying diagram (fig. 1) illustrates the relationship of the various organs of reproduction.

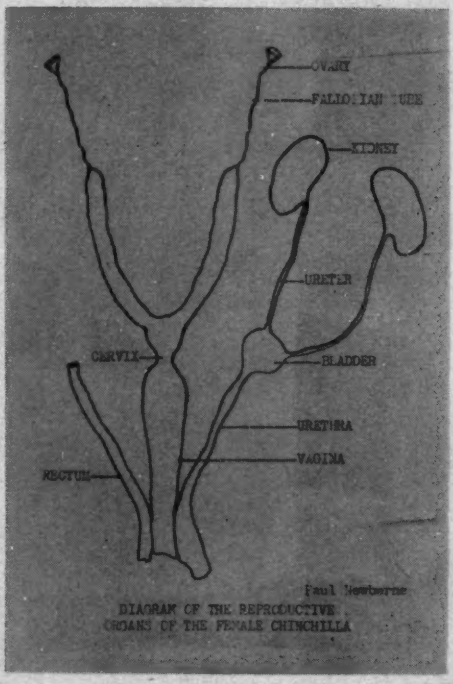

Fig. 1.

Technic. The instruments needed for the operation consist of two scalpels and blades, one pair of scissors, one pair of thumb forceps, two pairs of tissue forceps, four hemostats, and needle-holder. Materials that should be on hand include sterile gauze, hypodermic syringe and needle, an assortment of suture needles, suture material, aqueous penicillin, and possibly a stimulant. It has been the experience

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of the authors that no. 000 chromic catgut will suffice for the necessary closures throughout the operation. An atraumatic needle is preferred.

As has been demonstrated with other animals, a preanesthetic is indicated in reducing hazards of general anesthesia. Demerol is the drug of choice, the dosage ranging from 0.2 to 0.3 mg., to be administered 30 minutes prior to administration of the general anesthetic. Ether has been employed successfully. The only disadvantages of this volatile agent is excessive salivation accompanying its use. Atropine may be used (1/400 gr. administered subcutaneously) to counteract the salivatory properties of ether. As further insurance against strangulation, the patient is secured on an operating board, the head being lowered at a 30-degree angle.

After loss of reflexes, the surgical site is carefully prepared to assure asepsis.

With constant consideration of the extreme thinness of abdominal musculature, a liberal skin incision is made from the umbilicus to a point just anterior to the pelvic inlet. The muscle fascia is then grasped with a pair of tissue forceps and elevated to a point where scissors may be inserted without endangering the contexture of the intestinal wall. The muscle tissue is carefully cut and retracted with tissue forceps. A duplicate procedure is followed for severing the peritoneum.

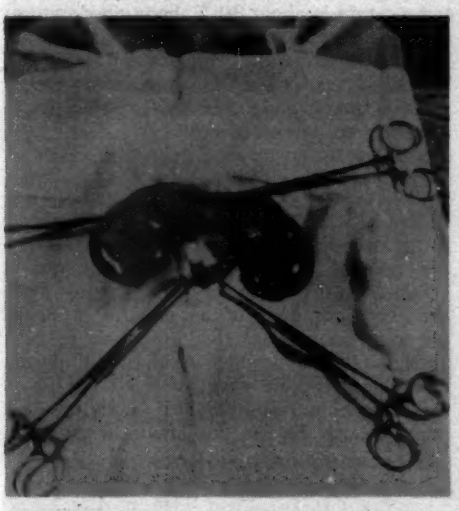

Fig. 2. The uterine horns are exposed outside the abdominal cavity before removing fetuses.

After entrance into the adbominal cavity, the uterus is located and the horns exposed outside the peritoneal cavity to allow fetal fluids to drain outside (fig. 2). If the occasion arises, the operator should not hesitate extending the incision anteriorly in order to facilitate the removal of fetuses. Adequate exposure is of paramount importance, thus minimizing trauma and the possibility of postoperative shock[4,5]. Blood therapy, the foremost means of combating surgical shock,[6,7,8] has not been developed for the chinchilla.

Fig. 3. The skin incision is carefully closed by subcuticle suture to assure against self-injury.

When the uterus has been made accessible, the uterine musculature is incised and the fetus (or fetuses) removed. It may be necessary to make an incision in both horns. In order to maintain asepsis, it is important to have an assistant handle the young, the same care being required as for any other species delivered by cesarean section. A sudden expulsion of air into the face of the newly-born kit will often relieve the respiratory mortification accompanying cesarean delivery. After the young have been retrieved, it is extremely important that all fragments of the fetal membranes be removed. A retained placenta appears to be highly fatal in the chinchilla.

If the uterine content is normal and all fetuses and membranes have been removed, an aqueous solution of penicillin is employed to flush the uterus. The wound edges are

cleaned and closed with a continuous, inverting type of suture. It has been pointed out that no. 000 chromic catgut is serviceable in bringing wound edges in apposition. In closing the abdominal wall, it has been found that a separate line of peritoneal suture is unnecessary. Better results are obtained with a through and through muscle-peritoneal suture. Since the chinchilla is prone to gnaw any visible suture material, a continuous, subcuticular stitch is preferred in closing the skin incision. In this way, complete closure is attained without the presence of surface suture material for the annoyance of the animal (fig. 3).

Compression bandages or dressings of any description are not advisable. As a safety precaution, it has been the practice to keep the animal on antibiotics for several days following the operation. Penicillin (50,000 units per day) is recommended. The kits should be given access to the mother's milk immediately following recovery from anesthesia.

Postoperative care. It is to be remembered that the environmental temperature to which the chinchilla is adapted ranges from 55-80 F.°. Higher temperatures must be avoided and dryness with freedom from drafts are absolutely essential°. Experience has shown, however, that the upper level of the given temperature range is indicated until recovery from anesthesia has been complete.

Summary

The increasing demand for the cesarean section in the chinchilla has been pointed out, and the simplicity of the surgical procedures illustrated and an attempt made to present complications which one may expect.

It is hoped that this presentation of the technic employed for successful surgery will stimulate the interest of readers for further investigation in a promising field.

REFERENCES

1. Young, A. V., Cesarean Section in the Cow. *Vet. Med.*, 48:228 (June), 1953.
2. Farquharson, J., and Delahanty, D. C., Fetal Dystocia and Successful Cesarean Section in a Mare. *Jour. Am. Vet. Med. Assn.*, 120:129 (Mar.), 1952.
3. McCunn, J., Hobday's Surgical Diseases of the Dog and Cat, 4th ed. The Williams and Wilkins Company, Baltimore, 1941.
4. Dukes, H. H., The Physiology of Domestic Animals, 6th ed., Comstock Publishing Company, Inc., Ithaca, N. Y., 1947.
5. Guard, W. F., Surgical Principles and Technics, Edwards Brothers, Inc., Ann Arbor, Mich., 1951.
6. Penny, S. G., Blood Substitutes or Plasma Extenders for Small Animal Practice. *Vet. Med.*, 48:151 (Apr.), 1953.
7. Bild, C. E., Blood Transfusion in Dogs, *Vet. Med.*, 48:413 (Oct.), 1953.
8. Hayes, F. A., Dorsey, N. S., Radical Amputation of Scapula and Limb. *Vet. Med.*, 48:387 (Sept.), 1953.
9. Kennedy, A. H., Chinchilla Diseases and Ailments, Fur Trade Journal of Canada, Toronto, Ontario, 1952.

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Influence of Outside Temperatures on Animal Efficiency

External temperature, humidity, and air movements are reflected in well-being and food utilization in animals. In one research project it was determined that pigs weighing from 166 to 200 lb. at 60 F. gained 2 lb. per day or 4 lb. of feed per lb. of gain. At 40 F. the average rate of gain was around 1 lb. per day or 10 lb. of feed per lb. gain.

Cattle, on the other hand, have a better insulating hide than swine. Therefore, if they are protected from, cold winds and their quarters are dry, they can stand a temperature as low as zero with only slight detriment to performance or feed efficiency. However, when the outside temperature rises to 95 to 100 F. Holsteins, Herefords, and other European breeds are frequently in serious difficulty. The Brahma and Afrikander breeds are more tolerant to heat.

Baby pigs suffer much from cold, as indicated by the fact that when the environmental temperature is about 30 F. body temperatures at birth drop 9° below normal within 30 minutes after farrowing, and remain 2° below normal for as long as 48 hours later. Unless warmed quarters are provided baby pig losses are likely to be excessive.

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Mr. Jay Taylor, Amarillo, Texas, president of the American National Cattleman's Association told the House Agriculture Committee in Washington that he was sick and tired of hearing about surpluses of agricultural products. He went on to state that it is time to brag about ability to produce food for all during favorable years and have some left for use in the event of unfavorable crop conditions that might conceivably cut production in any year.

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The Georgia Livestock Development Authority designates a state agency, activated by executive order (Governor Talmadge), that eventually plans to underwrite livestock loans to farmers of the state.

Evaluation Of Meperidine Hydrochloride In The Cat

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A SURVEY of the literature has indicated that the dose of meperidine hydrochloride (*N*-methyl-4-phenyl-4-carbethoxypiperdine hydrochloride)** has not been established in the cat. There also appears to be some confusion as to whether or not the drug produces sedation in this animal species. In 1939, Eisleb and Schaumann[1] reported that meperidine, like morphine, produced hallucinations in the cat making it appear "mad." Other workers[2,3,4] have described the absence of sedation and the appearance of marked excitation after administration. Climenko,[5] on the other hand, reported that therapeutic doses of meperidine produced slight sedation and marked analgesia, but he failed to report the dose employed to produce this effect. Mayer[6] suggested that meperidine has potentialities as a safe, effective sedative and preanesthetic agent in cats. He noted that exceptionally aggressive animals were easily and safely given sodium pentobarbital and that considerably less pentobarbital was required for anesthesia than ordinarily would be expected on a body weight basis. The use of meperidine in large and small animals has been outlined by Archer[7]. He reported that the drug did not produce excitation and that it was a useful sedative in the cat. The dose recommended by Archer was the same as for the terrier dog or slightly less (analgesic dose 10 mg. and hypnotic dose 25-50 mg.).

From the literature survey it appears that the response (sedation and/or excitation) is related to the amount of drug administered to the cat. Since the information pertaining to therapeutic levels of meperidine for this animal is lacking, it was felt that a study was necessary for the establishment of this level.

Methods and Materials

The cats used in this study were of different ages, sizes, and sexes. One-hundred cats were employed in this experiment; ten were designated as controls and the remainder were tested with meperidine hydrochloride†. Dose levels of meperidine investigated were 5, 10, 20, 30, 40, and 50 mg. per kg. of body weight injected subcutaneously (table I). In order to avoid any possibility of cumulative action or tolerance to the drug, each animal was employed only once. The control group received 2 ml. of pyrogen-free, distilled water subcutaneously, and the same method of handling and recording was used as in the animals tested with meperidine.

Prior to the administration of meperidine or pyrogen-free distilled water, the rectal temperature, pulse rate, and respiratory rate (TPR), were recorded. Following the injection, the TPR was recorded every 20 minutes for a two-hour period. The pain threshold was measured in 70 cats (fig. 4) which were divided into seven equal groups, and given pyrogen-free distilled water or 5, 10, 20, 30, 40 and 50 mg. per kg. of meperidine, after which the pain threshold measurement was made at 30-minute intervals for two hours. The method of pain threshold measurement was an adaptation of the Ercoli and Lewis[8] technic of applying a constant radiant heat (pain) stimulus to the shaved thigh region which was blackened with liquid shoe polish to neutralize the effect of skin pigmentation. The onset, duration, and degree of analgesia were measured by recording the time (reaction time) elapsing between the beginning of the exposure and response of the animal to the stimulus.

Results

A slight rise in the rectal temperature occurred in the control group, and following dose levels of 5, 10, and 20 mg. per kg. of body weight. When 30, 40, and 50 mg. per kg. were administered, a marked rise in the

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**Other names associated with meperidine hydrochloride are isonipecaine, demerol hydrochloride, dolantin, pethidine hydrochloride, dolosal, dolantal, endolat, dispadol, and dolvanol.

The authors express their gratitude to Earl R. Rumley for his technical assistance.

†The drug preparation was supplied for this study by courtesy of Winthrop-Stearns, Inc., New York.

rectal temperature (fig. 1) occurred with a temperature of 107 F. in some animals. The pulse rate decreased in the control group and did not change much following 5 mg. per kg. The pulse rate increased after the administration of all other dose levels of meperidine with the most marked effect occurring after 30, 40, and 50 mg. per kg. (fig. 2). In some of the

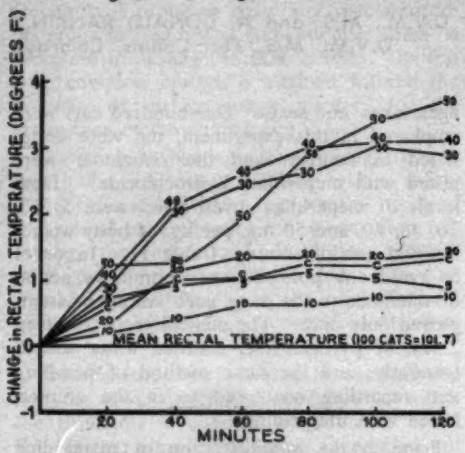

Fig. 1. Effect of 5, 10, 20, 30, 40, and 50 mg. per kg. of meperidine on the rectal temperature of the cat. The symbol C = control group.

animals the pulse rate was too rapid to be counted accurately. The respiration rate decreased in the control animals. After 5 mg. per kg. of meperidine, a rise was observed which was followed later by a drop. All other dose levels caused a slight to a marked increase in the respiration rate (fig. 3). In several animals a polypneic type of respiration was noted, especially in those which received 30, 40, and 50 mg. per kg. of body weight.

In the cats which received 5 mg. per kg. of meperidine, the degree of depression was hardly discernible. When 10 mg. per kg. of the drug was administered, five of the 25 cats in the group manifested slight restlessness and the others a slight degree of depression. In the animals receiving 20 mg. per kg., there were no obvious signs of depression; eight of 15 cats in this group became restless. Following dose levels of 30, 40, and 50 mg. per kg. marked restlessness was observed in all animals treated. Generalized muscular spasms occurred in several of these, which often terminated in a clonic convulsion (table 1). In two cats noise or touch appeared to initiate the clonic convulsion. Muscular twitching and spasms were noted to occur as soon as seven minutes or as late as 85 minutes following administration of the drug. The convulsive seizures usually lasted from 0.5-2 minutes. Occasionally more than one convulsive attack was observed; in four cats a second convulsion occurred, and in one a third convulsive seizure was seen. The interval between the convulsions was as short as 15 seconds or as long as 33 seconds. Eleven of the 26 cats manifesting convulsions were injected intraperitoneally with sodium pentobarbital to arrest the convulsive seizure. It was noted that 15-20 mg. per kg. of sodium pentobarbital was effective in arresting the convulsion and that profound anesthesia was produced. Although there were no deaths in the animals intentionally omitted from the sodium pentobarbital treatment, recovery from the excitatory effects of meperidine was lengthened considerably. The drug appeared to produce analgesia, although this could not be determined definitely. Since the results were so inconsistent (fig. 4), it was felt that the adapted Ercoli and Lewis technic for determining pain threshold could not be applied satisfactorily to cats.

It often was noted after the administration of 10 and 20 mg. per kg. that the cat assumed a "dog sitting" position and would stare peculiarly for several minutes. Emesis never occurred and defecation was noted in a few instances following administration. Urination occasionally occurred during a clonic convulsion. Profuse salivation and mydriasis were noted in several cats 1-20 minutes following the injection of 20 mg. per kg. or more of meperidine. Also there were several ani-

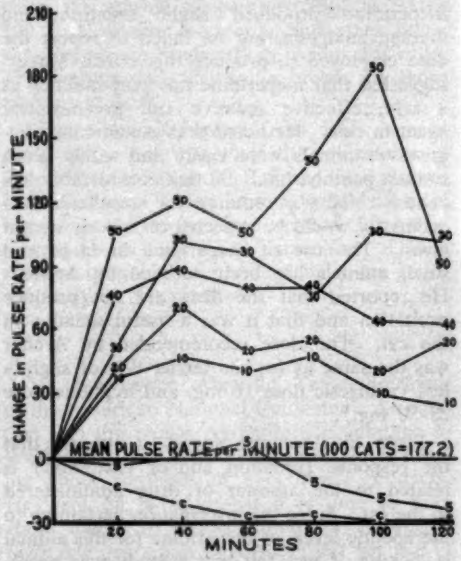

Fig. 2. Effect of 5, 10, 20, 30, 40, and 50 mg. per kg. of meperidine on the pulse rate of the cat. The symbol C = control group.

mals which seemed to have a fear of falling when removed from their cages, as indicated by a persistent clawing or clinging to the cage. It appeared to be related to the impaired vision which occurs concurrently with mydriasis.

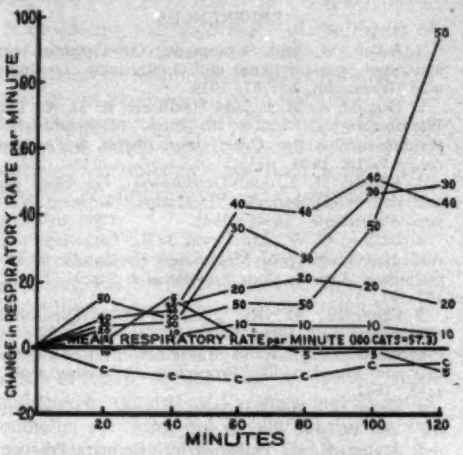

Fig. 3. Effect of 5, 10, 20, 30, 40, and 50 mg. per kg. of meperidine on the respiratory rate of the cat. The symbol C = control group.

Discussion

The increased rectal temperature observed in these experiments with the varying dose levels of meperidine may be indicative of an accelerated metabolic rate. A case of "demerol hyperpyrexia" was described in a human patient by Flipse and Flipse[9] with a definite relationship between the height of the fever and the dosage. A comparable effect on the rectal temperature was noted in our study in the cat. Flipse and Flipse reported that benadryl®[1] or decapryn®[2] given orally one or more hours prior to the administration of meperidine prevented the febrile reaction, and they therefore attributed the hyperpyrexia to an allergic action to the drug. Although this was not considered as a part of our study, benadryl was given orally in a dose of 5 mg. per kg. to five cats 45-60 minutes prior to the subcutaneous injection of 40 mg. per kg. of meperidine. Over a two-hour period following the administration of the drug, a rise of 104.1-107.3 F. was recorded in the rectal temperature and convulsions occurred in all of these animals. Since benadryl did not prevent the rise in temperature, it indicates, in cats at least, that the increased rectal temperature is not attributable to an allergic response. The increased pulse and respiratory rates observed in this study probably relate to the atropine-like properties of meperidine[5,10]. There are reports[4,6] stating that meperidine produces marked analgesia in cats. However, we were unable to determine, with any consistency, the degree of analgesia produced by the drug. In our study, the cat often struggled during the time the pain threshold was being tested, making it difficult to separate response to pain stimulus from voluntary activity. The "reaction time" to the pain stimulus had great intra-individual variation with and without meperidine. Beecher[11] reported that frequent discrepancies occurred in measuring pain threshold in human subjects using the Hardy-Wolff-Goodell method. He claimed that some pain threshold recordings were higher after the injection of isotonic sodium chloride solution and some were lower after the administration of morphine. An inquiry by Beecher revealed that his experience was common to many other groups, not only to those employing the Hardy-Wolff-Goodell method, but also to those using other experimental pain methods.

The degree of depression produced by meperidine in the cat was certainly not marked. This is in agreement with the work of Barlow and Lewis[4]. As the dose of the drug was increased, excitation was proportionately intensified in this study to the point that clonic convulsions developed. From the results of this study, the therapeutic dose of meperidine for the cat appears to be between 5 and 10 mg. per kg. of body weight. Although the degree of depression was not marked following this dose, the animals were easier to handle and to restrain.

TABLE I. Effect of Varying Levels of Meperidine in 90 Cats

Dose (mg. per kg.)	Cats Tested	No. Showing Excitation	No. Showing Muscular Spasms	No. Showing Convulsions	Deaths
5	10	0	0	0	0
10	25	5 (slight)	0	0	0
20	15	8	0	0	0
30	15	15	9	6*	0
40	15	15	13	11+	0
50	10	10	10	9++	0

Sodium pentobarbital (15-20 mg. per kg.) was used in 3 cats,* 1 cat,+ and in 7 cats++ of these respective groups.

The use of sodium pentobarbital was effective in arresting the clonic convulsions and the amount necessary was less than the usual

®[1]Parke, Davis & Co., Detroit, Mich.
®[2]Wm. S. Merrill Co., Cincinnati, Ohio.

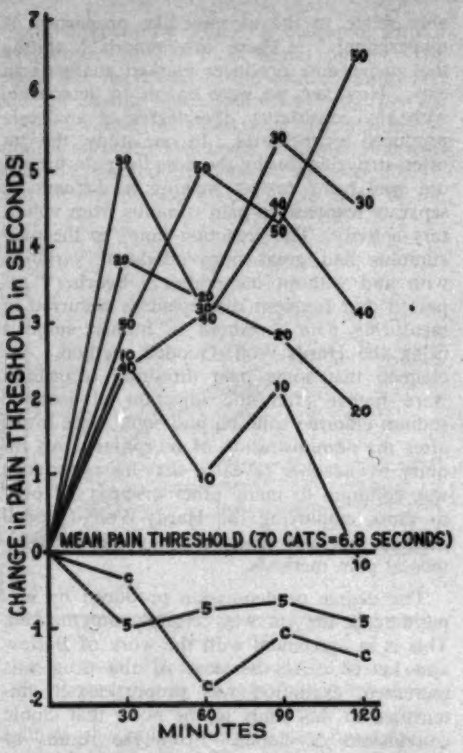

Fig. 4. Effect of 5, 10, 20, 30, 40, and 50 mg. per kg. of meperidine on the pain threshold of the cat. The symbol C = control group.

anesthetic dose. Way[13] has reported the use of barbiturates for arresting meperidine convulsions in mice, rats, and rabbits. He also pointed out that when meperidine was used in conjunction with barbiturates, a potentiation of the barbiturate depression occurred. There are other observers who have reported a potentiating effect when ether[12] and barbiturates[10,14] are used following meperidine administration.

Summary

1. A study was made with varying dose levels of meperidine hydrochloride in 90 cats.

2. The therapeutic dose range of meperidine for the cat appears to be 5-10 mg. per kg. of body weight when administered subcutaneously.

3. The animals became tractable and were easier to handle even though the degree of depression produced by this dose was not marked.

4. When 20, 30, 40, and 50 mg. per kg. were employed, excitement to severe clonic convulsions was observed.

5. Meperidine appeared to produce analgesia although this could not be determined satisfactorily by the Ercoli and Lewis technic.

REFERENCES

1. Eisleb, O., and Schaumann, O., Dolantin, ein neuartiges Spasmolytikum und Analgetikum. *Deutsche med. Wchnschr.*, 65:967, 1939.

2. Duguid, A. M. E., and Heathcote, R. St. A., The Pharmacological Action of Ethyl Methylphenylpiperidine-carboxylate. *Quart. Jour. Pharm. & Pharmacol.*, 13:318, 1940.

3. Kiessig, H. J., and Orzechowski, G., Uber die zentralen Wirkungen des "Dolantins." *Schmerz Narkose-Anaesthesie*, 14:41, 1941.

4. Barlow, O. W., and Lewis, J. R., Toxicology and Addiction Liability of Meperidine (Demerol) in Experimental Animals. *Jour. Pharmacal & Exper. Therap.*, 103:147, 1951.

5. Climenko, D. R., 1-Methyl-4-Phenylpiperidine 4-Carbonic Acid Ethyl Ester (D-140, Demerol): A Pharmacologically Active Substance with Atropine-like and Morphine-like Properties. *Federation Proc.*, 1:15, 1942.

6. Mayer, K., Demerol Hydrochloride as a Sedative for Cats. *N. Am. Vet.*, 26:477, 1945.

7. Archer, R. K., Pethidine in Veterinary Practice. *Vet. Rec.*, 59:401, 1947.

8. Ercoli, N., and Lewis, M. N., Studies in Analgesics I. The Time-Action Curves of Morphine, Codeine, Dilaudid, and Demerol by Various Methods of Administration. II. Analgesic Activity of Acetylsalicylic Acid and Aminopyrine. *Jour. Pharmacol. & Exper. Therap.*, 84:301, 1945

9. Flipse, M. E., and Flipse, M. J., Hyperpyrexia Due to "Demerol". *Southern Med. Jour.*, 42:395, 1949.

10. Yonkman, F. F., Noth, P. H., and Hecht, H. H., Demerol: A New Synthetic Analgetic, Spasmolytic and Sedative Agent. I. Pharmacologic Studies. *Ann. Int. Med.*, 21:7, 1944.

11. Beecher, H. K., Experimental Pharmacology and Measurement of the Subjective Response. *Science*, 116:157, 1952.

12. Way, E. L., Barbiturate Antagonism of Isonipecaine Convulsions and Isonipecaine Potentiation of Barbiturate Depression. *Jour. Pharmacol. & Exper. Therap.*, 87:265, 1945.

13. Rovenstine, E. A., and Batterman, R. C., The Utility of Demerol as a Substitute for the Opiates in Preanesthetic Medication. *Anesthesiology*, 4:126, 1943.

14. Barlow, O. W., Climenko, D. R., and Homburger, E., Comparative Potentiating Effects of Certain Therapeutic Agents of Sodium Evipal Hypnosis. *Proc. Soc. Exper. Biol. & Med.*, 49:11, 1942.

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The American Board of Veterinary Public Health has conferred an honorary fellowship upon Dr. J. L. Pawan, Trinidad, British West Indies, for his outstanding original research in the field of bat rabies.

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Research in pediatrics is revealing the important role of malnutrition and mineral imbalance in serious congenital anomalies.

EDITORIAL COMMENTS

Foot-and-Mouth Disease Report

Considering the importance of the threat of foot-and-mouth disease in Mexico to American livestock, authorities have been strangely quiet about progress in control of the disease since the outbreak reported in May 1953. Only infrequent, brief reports by the Joint U. S.-Mexican Commission have been issued. This dim-out of information was considered an ominous sign.

Apprehension has been relieved greatly by an April 14, 1954 release by Secretary of Agriculture Benson announcing intention to declare Mexico free of foot-and-mouth disease as of December 31, 1954. On that date the U. S. - Mexican border will be opened automatically to imports of livestock and livestock products, providing no further outbreaks occur. It is inferred from this that no new infection has been reported in Mexico since the last case occurred within the quarantined area in December 1953 and that infected and exposed animals have been slaughtered in accordance with demands of authorities from this country. Public opposition among Mexicans to the "sanitary rifle" possibly explains the reason activities of the Commission were not given wide publicity.

The news release referred to above announces successful termination of the "eradication phase" of the program. Testing and inspection procedures will continue for the remainder of the year. Notable is the fact that such effective steps were taken and carried out that the disease was confined to the original quarantined district comprising an area within a radius of 30 miles from the spot where infection occurred in May 1953. This fact deserves especial emphasis and justifies the high praise expressed by Mr. Benson to those workers, Mexican and American, who have directed the effort. It is also worthy of mention that cooperation of owners in a difficult situation contributed to successes so far obtained. More months of testing will secure against further outbreaks in this area. Restrictions on imports into Mexico also will be required to lessen the possibility of new infection, and it is presumed that authorities there now have realized the necessity for such import restrictions as are practiced in other countries free from this devastating plague.

QUESTION BOX

Explain sporadic outbreaks of hog cholera. **See page 233.**

? ? ?

What are the two principal methods of spread of leptospirosis? **See page 242.**

? ? ?

How can a rumen sample be an aid in diagnosis? **See page 221.**

? ? ?

What is the action and practical use of proteolytic enzymes? **See page 235.**

? ? ?

What groups of foreign diseases of domestic animals constitute the greatest threat to the American livestock industry? **See page 229.**

? ? ?

What dose of synthetic agents induces satisfactory analgesia in cats? **See page 249.**

? ? ?

How prevalent is leptospirosis in dogs in the United States? **See page 241.**

Incidence of Rabies in the United States — 1953

Statistics on the number of cases of rabies in the United States during 1953 have been collected by the Animal Disease and Parasite Research Board, Agricultural Research Service, U. S. Department of Agriculture. This material was compiled from returns of a questionnaire directed to state livestock sanitary officials and health officers. Differences in numbers reported by some states were noted, in which cases the largest figures were used, since it is beleived that reported cases do not represent all that occurred.

A total of 8,837 confirmed cases of rabies were reported for the United States. Of these, 5,688 occurred in dogs, 538 in cats, 1,012 in cattle, 21 in horses, 42 in sheep, 38 in swine, five in goats and, 14 cases in man. Rabies in wildlife was of especial interest in this year's report. A total of 1,033 foxes and 319 skunks were reported infected.

Again this year, Texas lead other states in number of cases of rabies, reporting 1,317, Kentucky reported 1,162, and Alabama 762.

Twelve states reported no cases and an additional five less than ten. Kentucky reported three human cases and Alabama one.

Highest incidence occurred in those states along the Ohio River and in the southeastern section, excepting Texas and New York on the southwest and northeast fringes of this large area.

A.V.M.A. 91st Annual Convention Seattle, Washington, Aug. 23-26, 1954

Seattle, Queen City of the Pacific Northwest, and a seaport of great importance, will be host city for the 91st annual meeting of the A.V.M.A. August 23-26, 1954.

Settled in 1851, the city was named after a Siwash Indian chief. Climate is mild because of the Japan Stream and the city is noted for its beauty. The 42-story Smith Tower and the 27-story Northern Life Tower have observatories from which visitors may view the entire panorama of Seattle and environs. The Lake Washington floating bridge is more than a mile long, and is the largest floating structure ever built by man.

News of completion of programs for the six sectional meetings has been announced by A.V.M.A. headquarters. Television will feature two of three sessions on General Practice, two of three sessions on Small Animals, and two of the two sessions on Surgery and Obstetrics. In all, six closed circuit television programs have been arranged by the cooperative efforts of the Allied Laboratories and the Radio Corporation of America. The three remaining sections are Research, Poultry, and Public Health.

Committee on Local Arrangements of which Dr. E. E. Wegner is general chairman and Dr. P. M. Hinze is vice-general chairman, has so far progressed with plans as to assure visiting veterinarians an outstanding program that will consider matters of current interest to practitioners. Scenic attractions of the Pacific Northwest and post convention tour plans also offer opportunity to combine a vacation with a convention trip.

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Traffic Safety

The year 1953 saw more than 2,000,000 causualities — the worst automobile accident toll in the nation's history—recorded on our streets and highways. This shocking record sets the year aside as a shameful one.

Even worse—except in a few cases where thoughtful people are much concerned about this mobile slaughter—the totals were recorded without many of us realizing what was happening.

The Travelers Insurance Companies of Hartford, Conn., report 38,500 people killed and 2,140,000 injured in 1953. Traffic deaths increased 900 and injuries jumped 50,000 over 1952.

The lessons to be gained from previous

A Familiar Scene at Seattle

Portage Bay, yacht anchorage on Lake Washington, Seattle. Campus of the University of Washington in the background. Lake Washington, 26 mi. long and 4 mi. wide, is connected with Puget Sound by an 8-mi. ship canal and with Lake Union (2 mi. long.) in the heart of the city. The canal has extended Seattle's waterfront to 193 mi. and added a nontidal, fresh water harbor. Note sailing schooner at anchorage upper left center.

statistics continued unheeded in 1953. Excessive speed was the most dangerous driving mistake again last year. Speed killed 13,870 persons and injured 600,000. Three out of four auto accidents happened to passenger cars driving in clear weather on dry roads, and 80% of vehicles involved in fatal accidents were traveling straight ahead. The death toll increased for the fourth consecutive year.

There are hundreds of splendid safety organizations in this country dedicated to safety education. Many insurance firms make major efforts in this direction at considerable expense. In hundreds of communities, civic clubs have taken on the job of spreading safety information and education. State and community authorities have spent millions of dollars in an effort to provide safer and better roads and highways. Driver training programs at all age levels are aimed toward safer and saner driving.

State, county, local, and parkway police are constantly patrolling streets and highways. More and better engineered thruways are coming off the drawing boards. It appears to us that almost everyone is concerned with this needless slaughter and its accompanying waste of human and property values.

Almost everyone, that is, but the drivers.

The problem starts and could ideally end with the drivers. Who are the drivers?

Each one of us knows the answer to that question. Let each one of us ponder these latest grim figures and then determine a proper, safer and saner course of action.

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Rabies Control Progress in Chicago and Cook County

During the period January 1 through April 26, 1954, 5,007 persons were reported bitten by animals in the city of Chicago. Of this number, 4,046 involved animals whose owners were identifiable. Between the same dates, 481 heads were examined for Negri bodies of which 60 were positive. The net result, 790 persons were given the Pasteur treatment. In addition to the foregoing, 29 positive rabies cases were reported in the area of Cook County outside Chicago city limits.

Dr. E. C. Khuen, Cook County Rabies Inspector states that the control program has progressed satisfactorily and that the number of positive rabies cases now has been reduced to manageable proportions.

New Officers for the American Animal Hospital Association

The excellence of a scientific program prepared for the annual meeting of the A.A.H.A. attracted a record attendance for this group of approximately 750.

Three television sessions featured this meeting, held on the convention floor of New

Dr. C. W. Bower

York's Hotel Statler. These were devoted to laboratory procedures, thoracic surgery (with special reference to oxygen respirators), and ophthalmological technic of examination, treatment, and surgery.

Officers elected to serve for the ensuing year are: Dr. Charles W. Bower, president; Dr. William F. Irwin, president-elect; Dr.

Dr. W. F. Irwin

James H. Yarborough, vice-president; Dr. Wayne Riser, executive-secretary; and Dr. Arthur R. Theobold, treasurer.

Selected papers presented at this meeting will be published in early issues of this journal.

Dr. Joseph C. Flynn

On Monday, April 26, 1954, the career of Dr. Joseph C. Flynn, K.C.V.C. '10, was closed by death in his 75th year, at St. Mary's Hospital in Kansas City, Mo.

Dr. Joseph C. Flynn

Doctor Flynn's professional career was marked by distinguished service to small animal medicine and surgery. He was considered by many as the father of pet animal practice, having founded the Dr. J. C. Flynn Dog and Cat Hospital in Kansas City in 1910. He claimed to have established the first exclusive small animal hospital in the world, and the sign and door at 3038 Main St. was a familiar sight to a generation of Kansas Citians.

Doctor Flynn was born at York, Nebr. where he received his elementary education. During his school years at the Kansas City Veterinary College (closed in 1918) he planned with wisdom and foresight a practice exclusively devoted to the treatment of the ills of pets. His pioneer activities in this specialty set many precedents of practice technics, facility construction, and operating methods. He gained international reputation as an authority on pet animal treatment and surgery.

He was also in demand as a lecturer, and published articles on a wide range of subjects. He gained especial note for describing the technic of the sutureless oophorectomy in young bitches. He was also instrumental in the development and enforcement of the rabies control ordinance in Kansas City, which is still enforced and has proved an effective control program.

A willing consultant and teacher, Doctor Flynn undertook the burden of answering queries from veterinarians all over the country. For years this work required a great deal of his time. He was also active in local, state, and national association work and served as president of the American Veterinary Medical Association, 1935-36. He retired in 1940 after leasing his practice but resumed direction again during the lessee's tour of duty with the Veterinary Corps, and finally became inactive near the close of World War II.

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"Economic Parasitology"

In his address presented at the annual meeting of Livestock Conservation, Inc., Chicago, Feb. 18, 1954, Dr. D. C. Boughton dramatized the losses due to livestock parasites.

Assuming that all swine in the United States carried an average parasite load of ten adult ascarids (considered a conservative figure), 10,000,000 lb. of roundworms are produced annually. Resulting losses are not only those of damage to tissue and subsequent retarded growth of the host, but the cost in feed consumption of the annual pig ascarid crop is astronomical. Doctor Boughton referred to the work of Dr. L. A. Spindler (see VETERINARY MEDICINE, 46:421 [Nov.], 1951) in which weight gains were shown to be adversely affected in proportion to the number of parasites harbored. Uninfected pigs in his experiment gained an average of 0.8 lb .per day on rations fed whereas pigs harboring 12, 20, 39 adult ascarids gained 0.7, 0.5, 0.4 lb. respectively, and the pig with 109 worms revealed a net loss of 8 lb. at the end of the experiment.

Doctor Boughton stated that the young science of economic parasitology is revealing large economic losses from what has, up to this time, been shrugged off as mild parasitism.

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National security must not be auctioned to the lowest bidder. There are no bargains in safeguarding of our freedom. I have no quarrel with the objective of helping our allies in any way consistent with our own interests. It is a reasonable, a humanitarian, and a business-like purpose. But to deplete our own resources and weaken our own defenses is no answer, either to our allies or ourselves. I am confident that our people will not let this happen.—*Henry B. duPont.*

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It has been shown over and over that government inspection alone is not sufficient to guarantee good biologics or pharmaceuticals. There must be the desire on the part of the manufacturer to make them good.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Add Urea to Rations with Care

Now that urea is being used widely in dairy cattle feeds to increase rumen flora activity and aid in digestion of indigestible cellulose, it must be remembered that in excessive amounts, or when physically defective, urea is a toxic substance. In England it has been shown that ingestion of more than 3 oz. of urea daily has a depressant effect on milk production. Since, in a commercial form, urea has a tendency to become lumpy, care must be taken that, when mixing with rations, lumps must be completely broken up and thoroughly mixed. Lumps that are pea-size, or even smaller, may result in bloat, loss of appetite, or possibly fatality. In short, when urea is in the form of localized physical concentration so that white lumps are visible in the mixed ration, it is potentially dangerous.

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"Sunlight" Flavor of Milk

The flavor of milk may be affected harmfully by as little as 15 minutes direct sunlight exposure. This "sunlight" flavor develops quickly if permitted to stand in direct sunlight. Thirty minutes of the exposure is sufficient to remove all the vitamin C and about 20% of vitamin B_2 (riboflavin). Such deterioration could be avoided by delivering milk in amber-colored bottles, or less expensive, and equally efficient, by providing light-proof milk boxes in which milk may be placed upon delivery. This is worth advising your clients.

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Eczema Due to Detergents

In conversations with practitioners who specialize in the treatment of small animals, we learned that occasional complaints are received from clients that after washing or bathing pets, there appears to be irritation or pruritus, as evidenced by scratching and rolling on rugs and in grass. Those doing the bathing in some instances, especially hospital helpers who may bathe many animals daily, complained of itching and dryness of the skin of the hands. We cannot make a positive diagnosis of this condition as we do not possess all the facts, but we know that, in human medicine, there is a condition generally spoken of as "housewives' eczema" which is generally assumed to be caused bys ome of the modern synthetic detergents. If a practitioner learns of comparable cases, it might be well to warn against the repeated use of detergent cleansing agents.

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Cat Scratch Fever

Daniels and McMurry, report (*Jour. Am. Med. Assn.*, 134:1247 [Apr. 10], 1954) 160 cases of cat scratch disease in man. Hundreds of cases are known to have occured in Europe and America. Most of the patients were children under ten years of age, though 70-year-olds were also victims. The disease follows a scratch by a cat. In most patients, there is low fever and mild systemic symptoms; a cutaneous rash may appear, and, in the more severe cases, encephalitis may develop. From the standpoint of clinical differential diagnosis, there are the following to bear in mind: Tularemia, infectious mononucleosis, lymphosarcoma, Hodgkins disease, tuberculous adenitis, lymphogranuloma, and both malignant and benign tumors. The specific etiological agent has not been isolated, though an antigen has been used intradermally with helpful results. Before being used for diagnostic purposes the antigen is used on known positive reactors, and on healthy controls. Surgery and sulfonamides, together with such antibiotics as oxytetraclycline, chlortetracycline, and chloramphenicol are resorted to in treatment. Veterinarians can be helpful to clients by advising early medical care of patients exhibiting suggestive symptoms.

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Removal of Keloids

Cornbleet, in the Apr. 3, 1954 issue of the *Jour. Am. Med. Assn.*, reports on, Treatment of Keloids with Hyaluronidase. His article is summarized as follows: "Twenty-six patients with keloids were treated with radiotherapy and local injections of hyaluronidase. In 22 this form of treatment was coupled with surgical removal. None of the keloids recurred. Histological studies furnished suggestive evidence that the enzyme interfers with the basic pattern of the keloid."

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
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Turkey Sinusitis — An Addendum

In the May 1954 issue of VETERINARY MEDICINE, page 214, infectious sinusitis of turkeys is discussed. Unfortunately, this article, originally written for publication in 1952, is not up to date because of important research work which has been done since then. For additional information, the reader is, therefore, referred to a review on chronic respiratory disease (CRD) published in the January 1954 issue. CRD of chickens and infectious sinusitis are now conceded to be caused by the same etiological agent, or combination of agents. A pleuro-pneumonia-like organism has been shown to be an important factor, if not the sole cause, of these diseases. The possibility of the need for the combination of a virus or other agents with the pleuro-pneumonia-like organism for production of the typical disease as seen under field conditions still exists. Certain stress factors such as overcrowding, large populations in a single house, ventilation, and seasonal weather conditions, also are thought to be important in determining the acuteness and severity of CRD and infectious sinusitis.

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Parthenogenesis in Turkey Eggs

Two scientists, M. W. Olsen and S. J. Marsden, at the USDA, ARS research center at Beltsville have made the important discovery that embryos can develop in unfertilized turkey eggs (*Agr. Res.*, 2:4 [Aug.] 1953). They found embryonic membranes and retarded embryos in 15% of eggs laid three to six months after all males had been removed from the flock. They also found embryonic tissue in eggs from Beltsville Whites that had been kept from all contact with male turkeys. More recently, the investigators have issued a news release that a turkey poult has hatched from such an unfertilized egg.

The parthenogenic development is slow starting and continues for only a few days. For example, embryos in normal fertilized eggs can be demonstrated in 18 to 24 hours, but these are not visible to the candler for about five days. Very few of the parthenogenic embryos develop normally. In about 98%, cell development is unorganized and produces only a translucent membrane which spreads, cap-like, to cover part or all of the egg yolk. Parthenogenic cell tissue, according to the investigators, could account for some apparently fertile eggs that do not hatch.

These are claimed to be the first cases of advanced parthenogenesis ever to be reported in birds or other animals. According to the report, natural parthenogensis is common in the lower animals such as bees and aphids. Also, it is known that a small percentage of infertile frog eggs, which are pricked with a needle, will start development and a few of these will produce tadpoles.

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Mash Hopper Space for Laying Hens

In the October 1953 issue of VETERINARY MEDICINE, *page* 420, the minimum hopper space requirement for laying hens is given as 32 linear feet per 100 hens. This is the recommendation of the American Association of Feed Manufacturers. A detailed report on this subject is given by Lee, Henry, and Presto in *Poultry Sci.* 31:290 (Mar.), 1952. Additional research by Lee and his colleagues is reviewed by *Nulaid News*, 31:18 (Mar), 1954. Lee now recommends a minimum of 36 feet for the usual types of feeders, and as much as 48 feet for automatic feeders. He states that for maximum egg production with all-mash rations, it is necessary to have somewhat more space available than where mash grain and supplementary pellet ration are used.

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Salmonellosis in geese caused by *Salmonella darby* is reported by McCarty (*Jour. Am. Vet. Med. Assn.*, 122:386 [May], 1953). A total of 125 goslings, eight weeks of age, were in the infected brood; 40 died and at least an additional 43 exhibited symptoms. Sulfamethazine in 0.097% concentration in the drinking water had no apparent effect on the course of the disease. Neomycin sulfate given at the rate of 0.05 gm. *per os* reduced losses. The mortality in a treated group was 6.25% as compared to 54.54% in an untreated group.

PUBLIC HEALTH

JAMES H. STEELE, D.V.M., M.P.H.
Atlanta, Georgia

Epidemiology of Brucellosis

In a recent paper entitled, Epidemiologic and Clinical Studies on Brucellosis, 1937-1952, by Wesley W. Spink*, further evidence is presented that brucellosis is an occupational disease. In a series of 110 human cases from which the Brucella organism was isolated, 94 were infected with *Br. abortus*, 11 with *Br. suis*, and five with *Br. melitensis*. Epidemiological breakdown of the 94 patients with *Br. abortus* infection revealed that 80, or 85%, of the cases occurred in males. Infection generally occurred between the ages of 20 and 50. It is interesting to note that three cases were reported in children under the age of ten years. Of the 94 cases studied, 56, or 59.6%, occurred in farmers or employees of meat packing plants. If the reports of the farmers' families and veterinarians are included the total number of cases due to occupational exposure is 70, or 74.5%, of all cases.

Two points are emphasized by Spink with respect to employees in meat packing plants: (1) Ten of 27 employees having brucellosis due to *Br. abortus* had direct contact with only pork or pork products. This indicates that the porcine tissues were infected, a fact previously reported by a study made in Chicago. (2) Ten carpenters or construction workers, and two women having the disease did not come in direct contact with animal or meat products. It is not known definitely in which manner these individuals became infected, but there is the implication that the immediate environment of a plant must be heavily contaminated at times, suggesting the possibility of air-borne disease. Of the 29 farmers who were closely studied in this series, 10 had a history of handling aborted material, another 14 had infected animals on their premises. In five instances among farmers, sources of the infection were not ascertained.

The elimination of brucellosis as a human disease is solely dependent upon the eradication of the disease in domestic animals. In the United States the major reservoir is in dairy cattle, although swine brucellosis is also of concern. Fortunately veterinarians, livestock sanitary officials, and public health authorities have adopted the philosophy of complete eradication of the disease rather than living with it. The success of this philosophy is reflected in the decline of human brucellosis in the past decade from a high of more than 6,000 reported cases shortly after the war, to slightly more than 2,000 in 1953. Veterinarians have a responsibility to clients and to themselves to encourage farmers to rid their herds of infected animals.

*Spink, W. W., Transactions and Studies of the College of Physicians. Philadelphia 4 Ser., 21:2 Aug. 1953.

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Trichinosis in Arctic Animals

One of the most amazing reports of disease occurrence has been the publishing of data on the prevalence of trichinosis in arctic animals. Hans Roth[1] of the Royal Veterinary College, Copenhagen, has published data which reveals that sled dogs are commonly infected in the Arctic. In Greenland, 70% of the dogs studied were infected. Of the polar bears surveyed. 30% were diseased. Other animals found infected were arctic foxes, bearded seals, and whales. Investigations in Alaska have shown that trichinosis is prevalent among arctic and marine animals. It is possible to explain how dogs, foxes, bears, become infected but the finding of the parasite in marine mammals, which are largely fish eaters, raises a question which is not readily answered.

The incidence of trichinosis in man in the Arctic is unknown. Danish investigators have suspected that trichinosis may have been the cause of the death of many arctic explorers. S. A. Andree, a famed Swedish arctic explorer and aeronaut who attempted to fly over the North Pole in 1896 in a balloon was among those who died of unknown causes. He and his party failed to fly over the Pole but did land safely near Spitzbergen. When the camp was found the following year, Andree and the other members of his party were dead. Surprisingly, the camp was in order and there were sufficient food stocks and supplies. For more than 50 years no one knew the cause of their deaths. After Roth's report, there was speculation that they may have died of an acute trichinosis infection.

[1]Roth, Hans., Trichinosis in Arctic Animals. *Nature*, 163:805, (May 21), 1949.

Infectious Keratoconjunctivitis of Cattle

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Infectious keratoconjunctivitis, or "pinkeye," is an important disease hazard in beef and dairy cattle. It is characterized by an acute to chronic inflammation of the eye and affects cattle of all ages and breeds. Corneal opacities and ulcerations may appear quite suddenly. Pinkeye is painful and, because of resulting photophobia, affected animals keep lids closed in sunlight. Impaired vision, persistent lacrimation, and peripheral corneal vascularization also are usually present.

Infectious keratoconjunctivitis is transmitted readily from animal to animal by direct contact. In dairy herds, the house fly is thought to be a carrier[3]. Incubation period varies according to climatic conditions; 48 hours to one week during the spring, summer, and early autumn months, but may be prolonged to three or four weeks during the winter[3]. Spread in a herd is rapid. Breed infection appears to be highest in Herefords.

Blakemore[6] and Coles,[6] as cited by Barner,[4] suggest that the causative agent of conjuntivitis and keratitis of cattle is a rickettsial-like organism, *Colesiota conjunctivae (Rickettsia conjunctivae)*. American workers[8,9] have incriminated a bacterial agent, *Moraxella bovis (Hemophilus bovis*[8]*)*.

Reid and Anigstein[8] showed that *Hemophilus bovis* would reproduce the disease and that neither a rickettsial nor viral agent could be incriminated.

H. bovis has been found by Schlingman and Manning[10] to be susceptible to chloramphenicol (chloromycetin®) in rather low concentrations. From this knowledge, and because of preliminary studies of chloromycetin by Hali-Patch,[11] field investigations of chloromycetin ophthalmic ointment, 1%, were started.

Materials and Methods

In every instance a stock chloromycetin ophthalmic ointment, 1%, was used.

All animals were kept under range conditions and were presented to the writer for treatment.

Although no bacteriological examinations were made, all animals exhibited the symptomalogy to this condition.

All animals treated were put in a squeeze chute with their heads held securely. Chloromycetin ointment was placed under both eyelids; the eye was then massaged gently with the palm of the hand until the ointment was thoroughly dispersed. Applications were made once daily.

Case Histories

A total of 110 Hereford cattle suffering from pinkeye were treated with chloromycetin ophthalmic ointment, 1%. These animals were presented in five lots:

Lot 1. Eighteen Hereford calves averaging 250 lb. weight and showing advanced pinkeye were confined for treatment in July. The history of these calves was unknown. Two were temporarily blind from the infection, three had one ruptured cornea each, and all others had ulcers on one or both eyes. All were treated once daily for six consecutive days, after which time they were returned to pasture. The remaining seven were treated once daily for another three days and then returned to pasture.

Treatment was discontinued in this lot when the acute inflammation had subsided and tissue repair was noted. At the last treatment, it appeared as though five of these calves would be left with scars on their eyes, but would be marketable as stock calves. No further observations were made.

Lot 2. On August 6, 112 Hereford calves weighing approximately 300 lb. were purchased in small lots. The buyer watched closely but saw no symptoms of pinkeye at the time of purchase. When loading on the evening of August 7, early infection was observed in two calves.

Upon arrival at destination, three days later, 19 calves exhibiting definite symptoms of pinkeye were housed in dark quarters and treated once daily for three consecutive days. At the end of this three-day treatment, all but three calves were improved sufficiently to be turned out to pasture. These three calves were given two more days of treatment.

On August 20, two of the first 19 calves and five new cases were confined two days for treatment and returned to pasture. One calf, treated twice previously, required another two days of treatment five days after completion of the second treatment with the ointment. All calves remained normal after this time.

Lot 3. Ten yearling and two year-old native, registered Hereford bulls, showing various stages of pinkeye, were treated every other day for three treatments with other pinkeye remedies. The bulls were left in the feed lot where pinkeye had been causing trouble for five weeks. Although this treatment had been administered, little or no improvement in the condition was noticeable. Chloromycetin ophthalmic ointment, 1%, then was applied once daily for three days. Marked improvement resulted. Further treatment was contemplated but neglected. The bulls continued to improve and no more trouble was experienced in this lot.

Lot 4. Eight native registered Hereford calves in the early stages of acute conjunctivitis were confined and treated with choromycetin ophthalmic ointment, 1%, once daily for three consecutive days. Two calves were temporarily blind and made a remarkable recovery after three days and were apparently normal in five days. Treatment was continued on two calves from this lot for seven more days. Progress on these two animals was not satisfactory, therefore treament was changed.

Lot 5. Since pinkeye is a problem in calves shipped into this locality from Texas, a load of 50 calves with the usual "dirty eyes" were all treated with chloromycetin ophthalmic ointment, 1%, as described, upon arrival. No pinkeye developed in these animals.

Discussion

Benefits derived from the use of chloromycetin ophthalmic ointment, 1%, in the treatment of pinkeye of calves warrants further investigation.

This antibiotic ointment gave excellent results in 110 Hereford calves when applied freely once daily. Adequate restraint is necessary so that the ointment may be thoroughly dispersed over the eye by massage. Ordinarily, recovery resulted following three to nine days' treatment. All animals should be placed in dark quarters during treatment.

No visible signs of toxity were noted.

Summary

1. Chloromycetin ophthalmic ointment, 1%, was applied locally in 110 Hereford calves showing symptoms of infectious keratoconjunctivitis.

2. Results of clinical use thus far indicate that this antibiotic ointment is effective in the treatment of pinkeye when applied freely once daily for three to nine days.

3. All animals treated were placed in dark quarters during treatment.

4. No untoward reactions were observed.

REFERENCES

1. Jackson, F. C., Infectious Keratoconjunctivitis of Cattle. *Am. Jour. Vet. Res.*, 14-19, 1953.
2. Blakemore, F., Conjunctivitis and Keratitis of Cattle and Sheep Associated with the Presence of Cell-Inclusion Bodies. *Jour. Comp. Path. and Therap.*, 57:223, 1947.
3. Coles, J.D.W.A., A Richettsia-Like Organism of the Conjunctival Epithelium of Cattle. *Jour. S. African Vet. Med. Assn.*, 7:221, 1936.
4. Barner, Ralph D., A Study of Moraxella Bovis and Its Relation of Bovine Keratitis. *Am. Jour. Vet. Res.*, 13:132, 1952.
5. Allen, J. A., A Preliminary Note of Infectious Keratitis. *Jour. Am. Vet. Med. Assn.*, 54:307, 1919.
6. Jones, F. S., and Little, R. B., An Infectious Ophthalmia of Cattle. *Jour. Exptl. Med.*, 38:139, 1923.
7. Baldwin, E. M., A Study of Bovine Infectious Keratitis. *Am. Jour. Vet. Res.*, 6:180, 1945.
8. Reid, J. J., and Anigstein, L., Investigations of Keratoconjunctivitis in Cattle on the Gulf Coast of Texas. *Texas Rep Biol. and Med.*, 3:187, 1945.
9. Klussendorf, R. C., Infectious Keratitis or Pinkeye. *N. Am. Vet.*, 33:616, 1952.
10. Schlingman, A. S., and Manning, Mary C., Unpublished data.
11. Hall-Patch, P. K., Keratitis in Cattle. *Vet. Rec.*, 63:824, 1951.

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Carcinoma in a Liger

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This is a brief report of a case of carcinoma in probably one of the rarest hybrids; namely, a lion and tiger cross. The Bloemfontein Zoo has bred six ligers, of which four matured, from a lion male and a tigress in 1935 and 1936. Of these only Rajah, the male is still alive. He is a magnificent specimen, weighing 750 lb. and standing 1½ ft. taller than an adult lion and is 9 in. longer in the head-to-tail measurements of the average lion. Of the three females, one was destroyed when she escaped from her cage, one died of septicemia and one of cancer.

A swelling was noticed on the left row of mammary glands of Diana, then age 18 years. This appeared to enlarge gradually and cause the patient considerable discomfort. General health and appetite was unaffected. Nine months after the swelling was first noticed this animal suddenly went off feed, and was destroyed after an illness of three weeks.

Postmortem examination revealed a hard mass of tissue in the left posterior mammary gland. The rest of the mammae were undeveloped. On section, this tumor appeared to

consist of connective tissue interspersed with areas containing a mucoid-like substance. There always had been a watery, bloody discharge from the nipple of the affected gland.

The abdominal cavity revealed an extensive distribution of tubercle-like nodules, involving the mesentery, peritoneum, ovarian ligaments, and the ovaries. The liver, kidneys and spleen were normal as was the intestinal tract. Lungs were dark in color, giving the impression of pigmentation and the surface was covered with crater-like areas, with raised edges, varying in diameter from 2 to 10 mm. On section, they extended into the tissue of the lung and were of a pale yellow caseous substance. The entire lung tissue was filled with these nodules.

No acid-fast organisms were found in smears made from nodules.

Specimens for histopathological examination from all the affected tissues were sent to the Pathology Department, Veterinary Research Laboratories at Onderstepoort and I am indebted to Dr. J. le Roux for the following report:

Infiltrating duct carcinoma of the mammary gland. The glandular tissue was atrophied and inactive. The interstitial tissue revealed fibrosis with a secondary inflammatory reaction. Metastatic lesions were present in all specimens submitted.

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Chloroform Anesthesia for Castration of Horses

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Veterinary practitioners generally have either discarded chloroform as a anesthetic for horses or never have employed this volatile agent because of the narrowness of safety margin. My experience, however, suggests that, if proper attention is given to administration, this method of general anesthesia has many advantages.

Chloroform is used routinely in our practice. We prefer to use it out-of-doors and select a location under a tree in a pasture. An ordinary slip halter is used to snub the animal close to the tree or post, and a gunny sack adjusted under the nose band, over the nostrils and mouth, and under the chin strap. (See fig. 1). When the halter is tightened it will hold the sack snug. We then put a lariat around the horse's neck and around the tree in the opposite direction to the halter rope. This is done for two reasons: (1) To hold the animal in the event that the halter slips or breaks, and

Fig. 1.

(2) to prevent circling the tree or post. With the head pulled snugly to the tree, we are ready to administer chloroform.

We take a position in front and to the side of the horse and pour about ¼ of a 1 lb. can of chloroform on the sack quickly. When the animal pulls back we wait for effect, as the patient may strike during the brief excitement stage. With the head held securely, danger of self injury is minimized. Loss of equilibrium is apparent rapidly, at which point we tailswing to the left side; the man on the rope

Fig. 2.

loosens the hitch so that the animal lies down in the desired position. Uppermost hind leg is pulled forward with a lariat. No other tying is done. (See fig. 2.)

Test reflexes at surgical site and administer more anesthesia as needed. In routine work the man at the halter removes the sack after the animal is down. Castration is completed before consciousness is regained. However,

prolonged surgery is possible as we have demonstrated on numerous occasions. I held a pony under complete anesthesia for almost three hours without ill effect. Recovery always is prompt.

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Probable Leptospirosis in an Orangutan

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Several years ago Jiggs, an orangutan purchased by donations of Kansas City school children, was brought to the Swope Park Zoo. He was extremely intelligent, mastered many tricks and became a great favorite of all zoo visitors.

At the age of six years, Jiggs developed a fatal illness of about two week's duration. Symptoms were predominantly hepatic with jaundice and toxemia. The beast was accorded the best of treatment by Dr. J. C. Flynn, prominent Kansas City small animal practitioner.

After death, the body was delivered to the Jensen-Salsbery Diagnostic Laboratory for autopsy by Dr. Carter Anthony and the writer. Necropsy findings were as follows:

Carcass was emaciated with icteric mucosa, subcutis and fascia.

Unguinal and axillary lymph glands were pigmented and icteric.

Liver was grossly enlarged, friable and with variable coloration. The gall bladder was normal in size and the gall duct patent.

Mesenteric vessels were hyperemic with a few petechia on the omentum.

Pericardium was not visibly congested but contained a large "chicked blood" clot. No gross lesions of the epicardium were noted. The heart blood was thin and pale. There was a large antemortem clot of the right ventricle with fixation of the heart valves.

The lungs were collapsed and flabby with some congestion of the lower lobes, a few anthracotic spots and some pleuritic adhesions.

Spleen was congested and closely adhered to the omentum while the kidneys were normal in size, free from infarcts, hemorrhage, or pelvic exudate, but intensely icteric.

The urinary bladder was contracted, very icteric, free of hemorrhage and carrying cloudy residual urine having the appearance of serous pus.

The stomach was empty of food, distended with gas but with no visible pathology of the mucosa. There was marked congestion of the duodenum with almost white, semi-liquid feces. No marked changes of the large bowel and no parasites were seen.

Mesenteric lymph nodes were enlarged and icteric. Congestion of the normal sized pancreas was noted.

Ribs and bones were of good quality as shown by tensile breaking point.

At the time, no serological tests for leptospirosis were available but frozen sections of the kidneys, silver stained, revealed many bacteria having the morphological characteristics of Leptospira.

On the bases of symptoms, necropsy findings and stained kidney sections, a qualified diagnosis of leptospirosis as the cause of death was given.

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Research work conducted on chickens at Pennsylvania State College indicates that about 1.72 lb. of droppings (wet weight) are produced for each pound of feed eaten. At that rate a hen will produce about 138 lb. of manure per year.

*Director, Professional Service Division, Jensen-Salsbery Laboratories, Inc.

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ABSTRACTS OF LITERATURE

Radiation Damage to Livestock

Apprehension has been caused among large segments of the population following newspaper reports that radioactivity produced from thermonuclear detonations has been detected in contaminated dust particles of the atmosphere. This apprehension has been especially prevalent among ranches in sections of the west adjacent to Nevada test areas.

An investigation of suspected radiation of cattle is reported[11] following a series of tests near Las Vegas, Nevada in 1953.

The authors state that particles of matter less than 5 microns in diameter may remain suspended in the atmosphere for long periods. If large, they fall to earth. Rapidity and pattern of fall-out is dependent on a number of meteorological conditions. "It is not inconceivable," state these authors, "that one day radioactivity may be found on the hide of cattle in your neighborhood. It might be on the hide of some that have died from causes unknown, and in fact, under circumstances which have you completely baffled. You will want to know the relation of the radioactivity to the death of the cattle."

A specific instance of loss in a range herd was cited. Several cows were dead or dying and carcasses of calves were found on a range 30 to 60 miles north of the bomb site. No specific cause of death could be determined by the veterinarian called on the case. Cows and calves were in fair condition considering the poor range conditions. Unthriftiness, emaciation, and keratitis were observed in some animals. Muscular incordination and excessive hoofwear were noted. Acute vitamin A deficiency was demonstrated later by assays of livers of calves autopsied.

Measurable radioactivity was present in the skin, ingesta, and bones of dead cattle. Ranchers insisted spontaneous deaths were the result of radiation sickness.

Sufficiently high doses of any electromagnetic (*x*-ray or gramma rays), or particulate radiation (beta particles, alpha particles, or neutrons) capable of producing ions in passing through matter may cause death. For borros the $I.d._{50/30}$ is about 650 roentgens (r) of gamma rays. Deaths do not occur with doses less than 570 r. Trials with Hereford cows exposed to 200 r. of gamma radiation indicated no clinical manifestations of effects. Damage to tissues may result from a high dose at one time or to relatively small amounts delivered over a long period. Measurable activity at examination is not conclusive, and subsequently lost through physical and biological decay. No skin lesions were observed, from which it was concluded that beta radiation was less than required to produce such lesions. However, wild horses exhibiting numerous beta burns were clinically normal.

The authors point out that when an animal survives a large dose of total body radiation, characteristic tissue changes result. These occur in certain glands and in the cellular elements of the blood. Evidence collected after exhaustive study and experiment indicated that the herd involved had suffered losses from causes other than radiation.

Concluding the report, it was stated that a careful survey is necessary before accepting radiation as a cause of death. Quantity and quality of radioactivity can be measured at any time and extrapolated into the past or future. It was emphasized, also, that biologic changes, while characteristic, are not specific and may be the results of other causes.

[11]Hartman, J. L., and Trum, Bernard F., An Investigation of Suspected Radiation Damage to Livestock. *University of Pennsylvania Bulletin 134*, 44:87 (Apr. 9), 1954.

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Saponin, one of many glucosides widely distributed in the plant world, including alfalfa and other forage crops, is incriminated as a cause of rumen tympany. When saponin in watery solution is shaken, it forms a durable foam. It is reported that eight times of ten it produces bloat when fed to cattle, sheep, and goats.

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Laboratory tests in Puerto Rico indicate that the mongoose (this animal is an important host of rabies virus in Puerto Rico) is naturally resistant to the effects of the hemolizing agent, warfarin. Other so-called rodenticides such as red squill, barium carbonate, strychnine, ground glass, ANTU (alpha-napthyl-thio-urea), arsenic trioxide, and others were found to be effective.

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An Irish Wolfhound on Columbus' ship is believed to have been the first dog of a recognized breed to set foot on American soil. —*Gaines Dog Research Center.*